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PACIFIC DISCOVERY

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PRE-DISCOVERY

THE SEARCH for a cover motif, symbolizing "Amber Through the Ages" while lending itself to purposes of design, ended quickly enough with the sassy little horse. Securing his photograph and his story, on the other hand, got the editor-AD a bit involved, and indebted to several persons. First of the chain is Paul Herrmann, in whose book *Conquest by Man* we recalled having seen the critter; then Harpers, who referred us in turn to Hoffmann und Campe Verlag of Hamburg, publishers of the original *Sieben Vorbei und Acht Verweht;* finally, from Ullstein Bilderdienst (Picture Service), Berlin-Tempelhof, we got the photo "mit Luftpost" and contracted a tangible indebtedness: "Dürfen wir Sie bitten, uns für die einmalige Reproduktion 15 Dollar zu überweisen" – not a bad price for a horse, unless you want to take into account his age. The back of the photo bore – only response to our request for data – the legend: "Pferd oder Elch aus Bernstein, 3. Jahrtausend v. Chr. gefunden in Waldenburg/Neumark." Add to this the caption in *Conquest by Man:* "Horse [not elk!] of amber. Was this delightful piece of amber carving, executed nearly five thousand years ago, a pendant on the necklace of some beautiful woman?" – a suggestion which contains our only clue to its size. The place is now in Poland, 90 miles from the Baltic. The peerless purveyor of gemixed paleontological pickles, historic and prehistoric puzzles, and natural history curiosities, Willy Ley, rounds the story off – and what more could we possibly know? – in *Dragons in Amber* (see page 5 for comments on the book): "Near Woldenberg in the province of Brandenburg . . . a carving made of amber has been found, a representation of a young wild horse, which has been dated as Late Stone Age – Neolithic, if you insist on the technical term." (We do not insist.) The chain properly begins, then – unless you want to go back to Eocene forests on the Baltic where amber began – with a certain very talented artist who one day held a lump of amber in one hand and a sharp flint in the other, and thought of a pawky little colt he'd seen lately. . . .

PD'S AUTHORS

FOSSIL LIFE in rock – or amber – intrigues **Dr. J. Wyatt Durham,** professor of paleontology at the University of California, Berkeley, for what it may tell of the age and nature of the formation bearing it. Two earlier articles here ("Sumatra's Minangkabaus and Bataks," 1948; "Hindu Temples of Padang Lawas," 1949) came out of his observations of human life, past and present, while working as petroleum geologist for Standard Oil in Sumatra. . . . ¶ **Dr. Paul D. Hurd, Jr.** is lecturer and assistant entomologist, U.C., Berkeley, and curator of the California Insect Survey collections. His colleague, **Dr. Ray F. Smith,** is an associate professor, teaching insect ecology, and associate entomologist, with work in the economic field in the Agricultural Experiment Station, Berkeley. . . . ¶ Our fourth amber-hunter, **Dr. Robert L. Usinger,** is professor of entomology, a taxonomist and teacher of systematics and limnology, and entomologist in the Experiment Station. He is editor of *Aquatic Insects of California* (University of California Press, 1956). . . . ¶ **Gertrude Duby** and her husband Frans Blom have for many years maintained a home and center for Scientific Studies at Na Bolom (At the Sign of the Jaguar) in the old city of San Cristóbal Las Casas, Chiapas, Mexico. Helen Augur has a brief but sympathetic account of the Bloms and their explorations in her *Zapotec* (1954). . . . ¶ **John L. Blackford** of Libby, Montana, is author of *Western Wonderlands: A Guide to Bird Habitats of the Western United States* (Vantage Press, Inc., New York, 1956), reviewed in this issue. . . . ¶ **Dr. Clement W. Meighan** ("The Nicoleño," *PD,* January-February 1954) is assistant professor of anthropology at the University of California, Los Angeles; **Keith L. Johnson** is one of his "students who has been active in our research on Catalina." D.G.K.

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HORSE IN AMBER, Neolithic, Germany-Poland (see PRE-DISCOVERY). Photograph from Ullstein Bilderdienst, Berlin-Tempelhof, Germany. Actual size and color not furnished.

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EDITORIAL

THE WORTH OF WILDNESS

O for a lodge in some vast wilderness,
Some boundless contiguity of shade!
COWPER

WILD, wildness, wilderness – for many of us today these wilding words are as beautiful in their connotation as in their sound. But not so long ago they gave men thoughts to shrink from, in contempt, or in fear. Take *wild:* in the grand old *Century Dictionary* (1889), it is "I. a. l. Self-willed; wayward; wanton; . . . 10. Living in a state of nature. . . ." In *Webster's New Collegiate Dictionary* (1949) it is "adj. 1. Living in a state of nature. . . ." And *wilderness:* quaintly in the *Century* it is "a tract of land inhabited only by wild beasts; a desert, whether forest or plain." Note the subtle difference Merriam-Webster recognizes after 60 years: "A tract or region uncultivated and *uninhabited by human beings*" (our italics). Cowper's "contiguity of shade" recalls Milton's "beck'ning shadows dire. . . . On sands and shores and desert wildernesses." Desert and wilderness were one, and either lifeless (Thomas Hood: "the wide desert where no life is found"), or exactly the opposite (Plutarch: "sandy deserts full of wild beasts") – *howling* wilderness! In any case, the two dictionary citations suggest it is not "what poet do you read" but "what century do you live in" that shapes your attitude.

It is improbable, if not perhaps inconceivable, that any century before the 20th could have given birth to a "Wilderness Society" not prefixed by "Anti-" or tolerated a succession of "Wilderness Conferences" not dedicated to man's subjugation of the wilderness wherever it still howled. But in this year 1957 we have attended The Fifth Biennial Wilderness Conference, sponsored by The Sierra Club in coöperation with The Wilderness Society and four other conservation associations *and* five major Federal bureaus. Pursuant to the theme "Wild Lands in Our Civilization," some 400 highly civilized men and women, assembling in San Francisco for two crowded days, talked of nothing but the worth, the absolute need, of wilderness for mankind, now and in future, and of ways and means not only to preserve what is left of it but if possible to create and sequester more. Clearly there has been a tremendous emotional shift. Does this modern setting of wildness with, not against, civilization rest on whim, like fashion in hats; or have we learned something new about the values in wildness?

Carleton S. Coon, curator of ethnology and professor of anthropology at the University Museum in Philadelphia, is one anthropologist more widely known to the public than most, because of his ability to project as a television personality and as a writer of very readable books. Dr. Coon's favorite occupation is digging in caves for evidence of ancient man. He tells about this both informatively and entertainingly in *The Seven Caves.* In the Neolithic levels of Belt Cave on the Caspian shore were bones of gazelle, sheep, and goats. Bones tell a lot, as Dr. Coon shows:

"The domestic animal bones were white, fatty-feeling, soft, and light, whereas the gazelle bones and those of the other wild animals were brown, hard, glossy, and heavy. The reason is that wild animals always arrive at a state of natural balance with the other elements in their environment, over periods of thousands of years, through nature's version of the trial-and-error process. . . . Wild grasses are never overgrazed and the wild animals that live on them are sleek and in good flesh. . . . When man began breeding animals he started with a poor lot anyhow, the ones that he was able to catch and tame. As time went on he began selecting them for qualities which had nothing to do with the balance of nature, but which suited his own needs. Thus, he bred animals that yielded exaggerated quantities of wool, milk, and fat; animals with thick fleeces, pendulous udders, and chubby bodies, caricatures of their wild cousins that still browsed the forests or leaped from crag to crag in the mountains. These unnatural beasts had developed nutritional requirements different from those of their free-ranging ancestors, and as they were also confined by herdsmen to smaller pastures than before, they upset the delicate balance between plants and animals which had hitherto obtained. Overgrazing led to soil erosion, and in some parts of the world . . . man-made deserts came into being.

"Meanwhile, the meat that the herdsmen ate came to differ from the hunter's fare. Animals living under domestication tend to have slender bones, tender flesh, and much fat. The body type that they have achieved under human interference with natural laws is exactly the one that in man himself is most prone to degenerative diseases, particularly, coronary attacks, linked to high cholesterol content, and in this sense the Neolithic farmers ate food inferior to that of hunters."

Came then agriculture, and that did it. With too much to eat, and time to waste, man took to inventing the evils of civilization, and especially to multiplying, so that eventually his numbers as well as his other troubles were compounded in geometric rather than merely arithmetical proportion. The crisis has come in our century. We are now equipped, poised, and ready, to destroy all our values and ultimately ourselves, either by means of that quintessential expression of civilization, atomic warfare, or by drowning ourselves in a rapidly rising tide of human flesh – the fleshpot will boil over if it doesn't disintegrate first.

Well, to murder a metaphor, we seem to be a sardine pack of poor fish in a pretty kettle of. What is the prospect? Let's ask a close student of mankind, his nature, and his history – again, Dr. Coon. If we do not set about solving our problems of "food supply, conservation, population-control, longevity, and education," he concludes in *The Story of Man* (1954),* "The earth's surface will be rapidly destroyed, if not by agriculture, then by our efforts to manufacture the tools, clothing, houses, vehicles, and highways needed by our ever growing population. The remaining forests will be felled, the desert flooded, and the few wild animals to survive man's final encroachment of their realms will flee to the mountaintops. As synthetically nourished human beings crowd one another on the same land surface that held a few million hunters only

*Reviewed editorially in *PD,* May-June 1955.

eight thousand years ago, the problem of social organization will grow too complex for solution without loss of the freedom for which we now struggle.

"One can never return completely to a previous stage of existence. We shall never be able to recapture the life of our ancestors of Upper Paleolithic and Mesolithic times, nor would we want to, because we could not bear to lose the scientific knowledge that we have slowly accumulated during the intervening centuries. We would do well, however, if some of us recaptured certain aspects of the hunting life which others of us have never lost. All anthropologists who have lived with primitive hunters report that they are sportsmen, gentlemen, and conservationists. Good manners, cooperation, and a respect for the plants and animals among which they live and from which they derive their food are basic hunting patterns of behavior. . . . Although we will not again be hunters . . . we can live and work most happily and efficiently if we reproduce, with modern improvements, some approximation to our ancestors' living conditions. A hunter needs space to move around in. He needs trees and grass and rocks and streams; he needs the presence of birds and animals, and the opportunity for exercise and recreation. He needs a job which is at times dangerous, and at all times sharpens his wits. . . . Above all he needs to be able to make decisions on his own. . . . If men are to be able to live in this fashion, the size of the earth's population needs to be sharply limited."

At hand are testimonials to the worth of this way of life, from men who exemplify to the *n*th degree Dr. Coon's "sportsmen, gentlemen, and conservationists." (It is surely unnecessary to emphasize that Dr. Coon's "hunting man" is not that callous wildlife butcher who all too often debases the term sportsman today.)

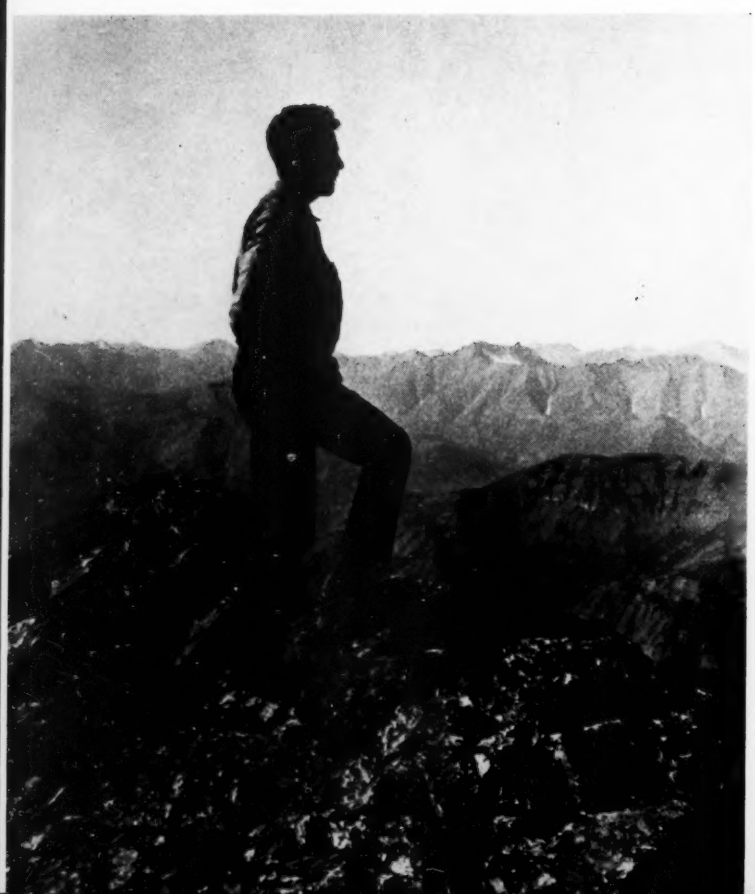
While Belmore Browne was painting the lofty background, dominated by Mt. Kenya's spire, for the buffalo group in the Academy's new Simson African Hall Annex, he endeared himself to all of us by his modesty, his unfailing friendliness and good nature. In his seventies, he was five-foot-six, and every inch a gentleman. Behind the wild grandeur of that mountain scene was the hand of a first-rate artist and the life's experience of one of the truly great mountaineers the world has known. Read *The Conquest of Mount McKinley* to learn how wilderness living can bring a man to his peak of fitness, to his physical and mental keenest, to his summit of esthetic and spiritual gladness. Mr. Browne's book is replete with bodily hardship and danger; and nearly every page sings the joy and the worth of wildness. "Day after day we pushed up the Chulitna River. We never knew monotony, for men who have reached the perfect physical condition that we had attained would find pleasure and enjoyment in anything. The bends of the cañon too beckoned us on, and stimulated our imagination. We always wanted to see what was around the next bend. . . ." And this is the hunting man, in need of meat, who has completed a successful stalk: "I sometimes think of the life in civilization in comparison with the life in the open, for a man can live ten years of the ordinary existence in a large city without once experiencing the intense, overwhelming emotions that ten minutes of life in the wilderness often hold for him." The "hunter" for whom this kind and degree of emotion waits in the wild may as well be armed with a camera, with a passion for the secrets of life, or with a burning yen for the sight of virgin country beyond the next ridge.

Just as that yen took Belmore Browne to unscaled McKinley, so a quarter century later it set Robert Marshall upon his *Arctic Wilderness* trail. McKinley no longer the challenge, Bob Marshall sought in the Brooks Range, our last continental rampart on the polar sea, the virgin wilderness which alone could bring to a modern, civilized man, "the exhilaration of that most glorious of all pastimes, setting foot where no human being has ever trod before."

Bob Marshall fully realized that in so doing he was "using up" some of the little remaining untrod land. But while fewer and fewer of us can ever "first set foot' in any truly unexplored parts, many are able to find and repossess the high human values which have carried over to us from a simpler age, even though a slice must symbolize the whole loaf.

Having them, we will not fail to see the need of planting these values anew in each generation. A Maine woodsman, Bill Geagan, has just written a little book, *Seed on the Wind,* to help fathers teach sons the ways and the worth of the wild. "I have long since learned," he says, "that the manmade troubles and cares that plague us in the daily grind of city life cannot survive in the environment of Nature." Among these are so-called juvenile delinquency. What we are learning about the values in living with nature is not new: it is ancient wisdom we had come close to forgetting. D.G.K.

NOTE: See book titles under Reviews.



Robert Marshall, on North Doonerak, Brooks Range, Alaska. (From *Arctic Wilderness*, courtesy University of California Press, Berkeley)

AMBER THROUGH THE AGES

J. WYATT DURHAM

amber (Old French *ambre*, from Arabic"*anbar*"). A yellowish to brownish translucent fossil resin, found in alluvial soils, with beds of lignite, and on some seashores. It takes a fine polish, and is used for pipe mouthpieces, beads, etc., and as a basis for a fine varnish. By friction it becomes strongly electric." (*Webster's New International Dictionary*, 2nd ed., unabridged).

THE VARIOUS SUBSTANCES collectively termed "amber" by the layman are separated by mineralogists into many types bearing different technical names. An authoritative work (Hintze, *Handbuch der Mineralogie*, vol. 1, 1933) recognizes two principal groups, the "succinite group" and the "retinite group," characterized respectively by the presence or absence of succinic acid. Thirty-nine named varieties are recognized in these two groups. Most of the Baltic amber – the bulk of the amber used for jewelry and similar purposes – is *succinite*. True succinite has been recorded from Simi Valley, California. The beautiful reddish amber from Sicily is called *simetite*. The amber from Burma, considerably harder than succinite and belonging to the retinite group, is termed *burmite*. Some other types are *rumänite* (from Rumania), *copalite* (mostly from England), *chemawinite* (from Canada), and *ambrite* (New Zealand). An earthy type from Ione Valley, Amador County, California, was named *ionite* in 1878. An amber from Baja California was given the name *bacalite* in 1935.

Chemically the various ambers are oxygenated hydrocarbons with organic acids such as succinic, formic, butyric, and cinnamic, or acid anhydrides as prominent constituents. They are usually composed of mixtures of the different chemicals in varying proportions thus giving rise to the many different named types.

In the table of mineral hardness amber varies from 1 to 3, or from as soft as talc (easily scratched by the fingernail) to as hard as calcite (easily scratched by a pocket knife), but most amber is around 2 (as hard as gypsum). Its specific gravity (weight compared to that of an equal amount of water) varies from 1 to 1.25, but is usually around 1.05–1.08. The color may vary from very pale yellow to golden yellow, green, brown, deep red, or black. The best amber is clear but may be cloudy or earthy in appearance. It is resinous and more or less brittle. It begins to soften at around 150° C. and will melt at 250–300° C.; these temperatures vary with the kind. It will burn easily, with the type of flame varying according to the composition, and gives off aromatic and often irritating fumes. By rubbing it becomes negatively electric and strongly attracts small pieces of substances such as tissue paper. This is one of the commonly used tests for recognition of real amber beads. Amber usually is fluorescent on fresh surfaces under ultraviolet light. The solubility of the different types varies greatly – some are easily soluble, others only with great difficulty. Ether, amyl alcohol, ethyl alcohol, methyl alcohol, oil of turpentine, chloroform, carbon disulfide, and alkalies are common solvents.

Inclusions are common in amber and often cause it to have a cloudy appearance. They range from numerous minute air bubbles, to sand grains, to complete organisms. Cloudy amber (usually caused by numerous small bubbles) can reputedly be cleared by boiling it in certain oils. A great variety of organisms and organic debris may occur as inclusions, ranging from hair or feathers to insects and a lizard as well as pollen grains, leaves, flowers and plant tissues. Sometimes the exterior of the organism is exquisitely preserved and material of this type has given the paleontologists glimpses of characters not seen on the more usual types of fossils.

Most amber or amberlike substances are derived from resins or gums exuded by various trees. Most Baltic amber is from an extinct pine to which the name *Pinus succinifera* has been given, but other amber trees include the true firs and cedars, the kauri gum (New Zealand), and assorted leguminous trees. When a tree is diseased or injured the resin is exuded and either collects at the point of injury or falls to the ground beneath. If it collects on the tree, the tree ultimately dies, falls to the ground, and decays. The resins do not decay and are not easily destroyed, so that the masses either collect in the soil or are carried off by erosion and eventually buried in deposits of sand or clay. These deposits ultimately reappear at the earth's surface as the rocks in which we now find amber. Because of its lightness amber is easily carried along by water currents and does not suffer as much destruction as other substances. Thus it may pass through several cycles of erosion and burial, so that a piece may be considerably older than the rock in which it is found. On the other hand most occurrences of the various ambers are associated with brown or lignitic coals or are in beds in which coals occur, indicating that the resins had not been transported much before burial. These ambers are thus of the same geologic age as the beds in which they are found.

Most Baltic, Burmese, southern Mexican, Indone-

Horse head pendant carved of amber, Etruscan, about 500 B.C. Actual size. (Courtesy the Metropolitan Museum of Art)

sian, and Philippine amber occurs in beds of "blue earth," sandstone, or clay, and is associated with marine fossils. This indicates that it has been transported by streams from the place where the "parent" trees grew to the ocean and there buried. When there are concentrations of amber in a bed, as in the "blue earth" of the Baltic area, it seems probable that there was a fairly direct transportation of the amber from the source area to the point of burial, and that geologically speaking, the amber is of the same age as the associated fossils. On the other hand, when the amber only occurs erratically, and at no particular horizon in the rocks, as in Java and Sumatra, the possibility that it is reworked from older beds appears to be nearly as great as the possibility that it is contemporaneous. In terms of geological time the few years required for its formation, transportation from the point of origin, and subsequent burial are negligible and cannot be measured by techniques now available except in the rocks formed during the latest Pleistocene (not more than about 35,000 years ago).

Young man's head of amber, Etruscan, about 500 B.C. Slightly enlarged. (Courtesy of the Metropolitan Museum of Art)

Amber inclusions. (*Left to right*) Beetle of family Diopsidae, now occurring only in tropics; a weevil or snout-beetle; a "pseudo-scorpion," *Cheiridium;* a very small member of a class of the Myriapoda (millipeds), the species, *Schindalmonotus hystrix*, now living in South Africa; another "pseudo-scorpion" riding a mosquito-like insect. (From *Dragons in Amber* by Willy Ley, courtesy The Viking Press, New York)

Most of the fossiliferous amber that has been examined by the paleontologists is of Cenozoic age – that is, it was formed during the last 75 million years of the earth's history. The amber from the Baltic primarily occurs in two beds, one of upper Eocene (the Cenozoic may be divided into six epochs, from oldest to youngest successively: Paleocene, Eocene, Oligocene, Miocene, Pliocene, and Pleistocene), and the other of lower Oligocene age. The Burmese amber is of Eocene age although it was assigned to the Miocene in early literature. The southern Mexican amber from the vicinity of Simojovel is of Oligocene and Miocene ages.

Pre-Cenozoic fossiliferous amber is also known. All so far recorded seems to be from the Cretaceous, the geological period next antedating the Cenozoic, and about 65 million years long. The Canadian amber from Saskatchewan seems to be of this age. Likewise the fossil amber found near Point Barrow, Alaska, comes from Cretaceous rocks.

Amberlike substances are known from older rocks also. The type called *bathvillite* occurs in torbanite or boghead coal in rocks of Carboniferous age (perhaps 250–300 million years old) in Scotland. It has been suggested as one possibility that it is altered lumps of resin. Relatively large amounts (in small pieces) of

Miniature amphora, amber. Etruscan, 6th century B.C. Slightly enlarged. (Courtesy of the Metropolitan Museum of Art)

→ Fragment of amber carving: head and left arm of one figure, left arm of another. Ionic or Etruscan, about 500 B.C. Somewhat reduced. (Courtesy of the Metropolitan Museum of Art)

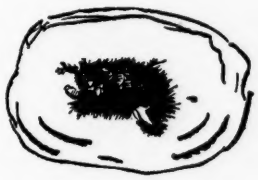
retinite are found associated with the coal at Coalmount, British Columbia, but so far no insects have been found there. Under extremely favorable conditions (no alteration due to metamorphism or deep burial under a heavy load of overlying rocks) it does not seem impossible that fossils may be found preserved in amber of pre-Cretaceous ages, perhaps even as old as Carboniferous.

Amber of one type or another has been found in numerous localities in most countries of the world where Cretaceous or younger sedimentary rocks occur, particularly in beds that contain low grade coal or lignite. Usually it is in rather small pieces, up to two or three inches in diameter, but one piece of Baltic amber weighed 18 pounds. Fossils have been found in only a small number of these occurrences, however, possibly because the amber has not been carefully examined for this purpose.

Amber has been collected or mined in a variety of ways. Baltic amber, which has been known since pre-historic times, is washed up on the shore and for a long time beach collecting was its only source. Collecting after violent storms was particularly good. Later fishermen raked the sea-floor with long poles. Then steam dredges were employed in the Samland area and finally, when the source beds were discovered, extensive mining operations were carried out both by tunneling and by quarrying in open pits. Over a million pounds a year for a few years were mined in this Baltic region in the period before Hitler.

The search for amber in other parts of the world has not been carried out as systematically as in Germany. In Burma pits are dug to a depth of about 40 feet by groups of two to four men using primitive equipment. The amber-bearing earth is hauled to the surface by hand where it is searched. In southern Mexico the natives know certain landslide areas and outcrops where amber is apt to be found. Occasionally one or two of them will spend some time digging for the mineral, otherwise they search the area after the rains or watch the banks of the streams leading from these places (the amber being light, it is easily carried along by the water and cast upon the bank). The chemawinite in Canada occurs along the shore of a lake where it is washed up and concentrated in considerable abundance. In New Zealand and Zanzibar the resins are dug from the ground, often in swamps or peat bogs.

Popular and romantic interest in amber may have waned, but students of past life seek it like gold in far places and despite hardships of the trail, as the stories here in "Roads to Discovery" will show.



Amber pendant: woman holding a child. Actual size. Etruscan, 6th century B.C. (Courtesy Metropolitan Museum of Art)

For further reading:

Dragons in Amber: *Further Adventures of a Romantic Naturalist.* By Willy Ley. The Viking Press, New York. 1951. viii + 328 pp., illus. $3.75.

The foregoing article is a capsule of fact designed to lead you onto the amber trail. Few "further readers," we feel sure, will be left unsatisfied by the two opening chapters of *Dragons in Amber,* a book which Willy Ley wrote, like his earlier *The Lungfish, the Dodo, and the Unicorn,* "because nobody else had." Ardent Ley fans give thanks for the prior omission, insisting that when it comes to this kind of book, "nobody else could." Willy Ley has indeed made the byways and back forties of natural history his own.

When it comes to amber, Ley is talking from his own back forty, East Prussia's Samland (he was born in Berlin). And his opening conversation piece is an amber bead he brought from the Samland. With it he brought to his writing some of history's, and prehistory's, most intriguing pages. They are imprinted with Neolithic art; a Bronze Age luxury trade when amber poured south to the Mediterranean, creating a trunk road and fantastic legends (amber was "The Tears of the Heliades" to use Ley's first chapter title); the speculations of Thales, Pliny, and Tacitus, who made the "splendid guess" that amber was resin from dense forests, his one mistake: he "believed these amber forests to exist in his own time." Here in the 13th century came the Teutonic Knights, with their profitable amber monopoly for the making of rosaries; after 300 years the Prussian state took over; finally, science plumbed "The Secret of the Blue Earth" (Ley's second amber chapter), and amber became a big modern industry, at a million pounds a year. D.G.K.

The Meaning of M

Paul D. Hurd, Jr.
& Ray F. Smith

Fungus gnat in amber, Simojovel, Chiapas. Probably Miocene. Actual size 2 mm. (less than 1/8 in.).

THE STORY of the insect-bearing amber recently discovered in the state of Chiapas, Mexico, is one so intertwined with other such finds elsewhere in the world and so filled with the romance of past and present Central American peoples that only some of the highlights can be related here.*

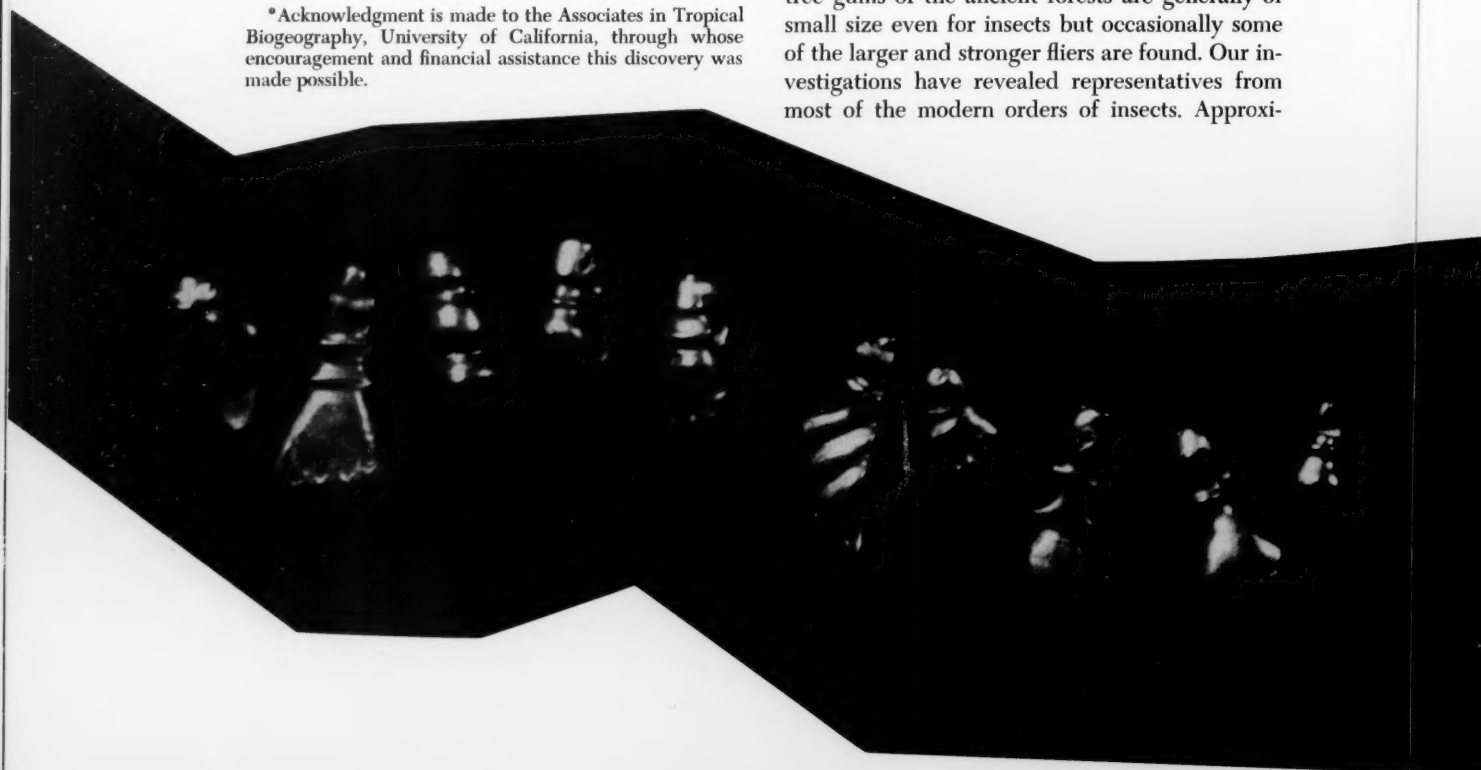
The Mayan culture like that of the Roman and Egyptian empires used amber for adornment, worship, barter, and burial plugs. It has been possible by amber alone to trace the ancient trade routes from the Baltic Sea near Samland, where fantastic quantities of Baltic amber were found, to the eastern Mediterranean. Large quantities of fashioned Baltic amber have been discovered, for example, among the burial effects of the great pyramids of Egypt. In Central America limited archaeological studies involving amber have demonstrated that there, too, amber may help to reconstruct ancient history.

In contrast, the story of Central American insects of some 20 to 30 million years ago is at our finger tips. These insects, which were so beautifully preserved in the fossilized tree gums of the prehistoric forests, are now clearly visible to us in the amber. They often appear virtually alive.

As each piece of raw amber is polished so as to more clearly expose a fossil insect, we are able to glimpse into these past millenniums of time. The examination of each piece is a thrilling and strange experience for the entomologist. Not only do we "collect" specimens of insects as they were 30 million years ago but when they are studied in the aggregate an amazing story begins to unfold. So far we have found quite a wide range of insect types and as each additional field collection of raw amber or newly acquired string of amber beads is examined, new types are discovered which serve to fill in the story.

The majority of the insects which became entrapped and subsequently fossilized in the sticky tree gums of the ancient forests are generally of small size even for insects but occasionally some of the larger and stronger fliers are found. Our investigations have revealed representatives from most of the modern orders of insects. Approxi-

*Acknowledgment is made to the Associates in Tropical Biogeography, University of California, through whose encouragement and financial assistance this discovery was made possible.



f Mexico's Amber

mately seventy-five species of these are distributed among the ants, bees, beetles, caddisflies, cockroaches, dustywings, flies, mites, moths and thrips. Still others of less well known groups are being discovered in each new shipment.

By far the most commonly encountered forms are the tiny flies and minute parasitic wasps, but this is not unexpected since these are types of organisms most likely to become entrapped on the sticky surfaces of exuding tree gums. Even in our forests of today one may see this happening. Indeed, collection of contemporary tree gums in our modern forests reveals to us the very earliest stages towards fossilization. Sometimes it is possible to watch a fallen lump of tree gum with its insect inclusions being washed down a river on its way to the ocean sediments, where ultimately it may become fossilized within the developing strata.

The Mexican amber insect fossils are approximately of the same age as those from the extremely rich Baltic amber deposits and of the famous Lake Florissant fossils in Colorado. This is in itself of considerable value in comparative studies for much will be learned about both past and present distributions. Moreover, since the Mexican amber is from more southern latitudes than that of the Baltic, the significance is even more impelling. From our studies we can see that some of the amber insect groups no longer occur in Chiapas, Mexico, and from this and by inference of known habits of these groups of insects, we can contribute to knowledge of the past climate and vegetation.

There is no evidence so far from the Mexican amber fossils to suggest any major evolutionary changes in these insects. While some species are different from our contemporary representatives, all can be placed in modern genera. Many of the fossilized forms are still present in the modern fauna as genera and possibly in certain instances as species. Perhaps one of the more interesting finds among the insects is the stingless bees. Before these finds there were known but two fossil species of this group, both from the more modern Sicilian amber. Special significance is attached to the older Chiapas amber stingless bees since it is believed by some experts that our honey bees arose from the stingless bee group through an intermediate form.

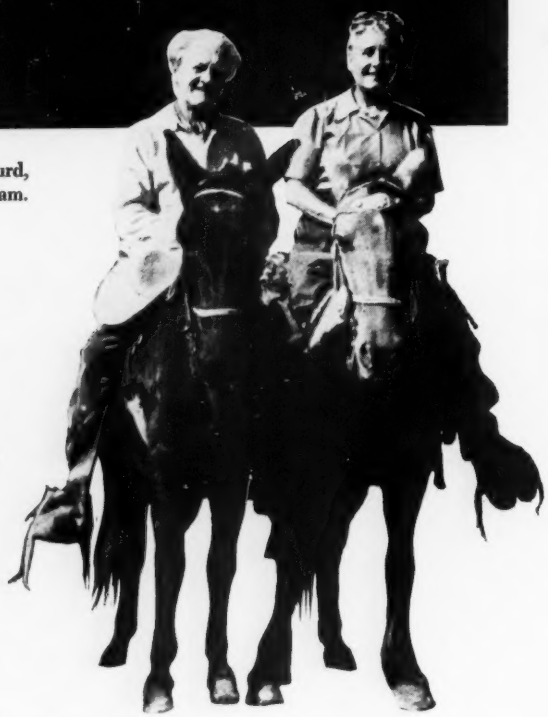
The solution to this problem and many others as pointed up by the very timely and successful discovery of the Mexican amber-bearing insect inclusions are taking much additional study by specialists in many fields. It is to be hoped that when these technical studies are done a more complete story of the past insect fauna of Mexico, as told by the insects in amber, may be written.

Amber beads carved by Indians, Simojovel, Chiapas. Somewhat enlarged. The gnat is in a bead like these.

ON THE AMBER TRAIL IN CHIAPAS

THE WHOLE THING BEGAN IN 1954 when the University of California asked my husband, Frans Blom, to investigate a region he had known many years. After studying the information about that trip and a second survey made in another region in June 1955, the University decided to send its own scientists down. The Associates in Tropical Biogeography of the University of California (Berkeley) made it possible for J. Wyatt Durham, Professor of Paleontology, and Dr. Paul Hurd, Entomologist, to come to Chiapas for an amber hunting expedition.

It was very cold the morning I left for Simojovel with Antonio, and Pancho, the two muleteers. We were quite an outfit riding out of Na Bolom, our home in San Cristóbal Las Casas. Two saddle mules for the professors from California, four pack mules, our three saddle animals – a string of nine beasts clattered out through back streets of the town. I felt lighthearted and ready to enjoy the three days alone on the trail. Two scientists from the United States – the idea terrified me a little. They were unknown quantities, and it can be bad on those back-country trails if you travel with fussy people. But I put all that out of my mind and had a pleasant ride through the Tzotzil country.



Hurd, Durham.

Frans and Gertrude Blom.

The last morning, on the future highway to Simojovel, we rode fast and my thoughts were uneasy. Frans had planned to fly to Simojovel if his health would permit it. He had had an attack of pneumonia two weeks before. Riding into Simojovel, I saw him standing at the corner of the plaza, a slight figure waving joyfully in my direction. Frans and I greeted each other as if we had been months apart. He was very tired yet, so I did the running around. The landslide of 1952 had to be cleared of brush, people with amber had to be found, last things had to be bought for the trip.

The day the Americans were due had come. We saddled up and rode down the half hour to the airfield. We waited for hours in the shade of a tree. Many planes flew over us toward Yajalon. Finally, one came

circling down and landed on the uneven field. People tumbled out of it and nobody could miss our two: Professor Durham, tall, heavy, with a nice smile; Paul Hurd, smaller, with reddish hair and a friendly face. We left the muleteers to pack, and rode up to town where Frans waited for us. The three men sat together on the porch of the little hotel. Frans gave the scientists his information and handed them his diaries and maps. One of the women who work the local amber turned up and sold her whole lot of crude and worked amber to the "gringos." She was happy to take the money but rather sorry to part with all of her amber, which the locals believe brings luck.

Next day we were up early, the animals were saddled and loaded, and we said goodbye to Frans. I left with mixed feelings. It is good to be on the trail if one likes the back country, but Frans was not well yet – and how would the two *norteamericanos* be on Chiapas trails? I wondered if I could help them adequately. They were pretty sturdy – that I had seen the day before when they explored the two mountain slides near Simojovel, climbing over the most awfully steep and slippery mudwalls, going through meadows full of ticks without blinking.

Our objective was an agrarian colony of Tzotzil

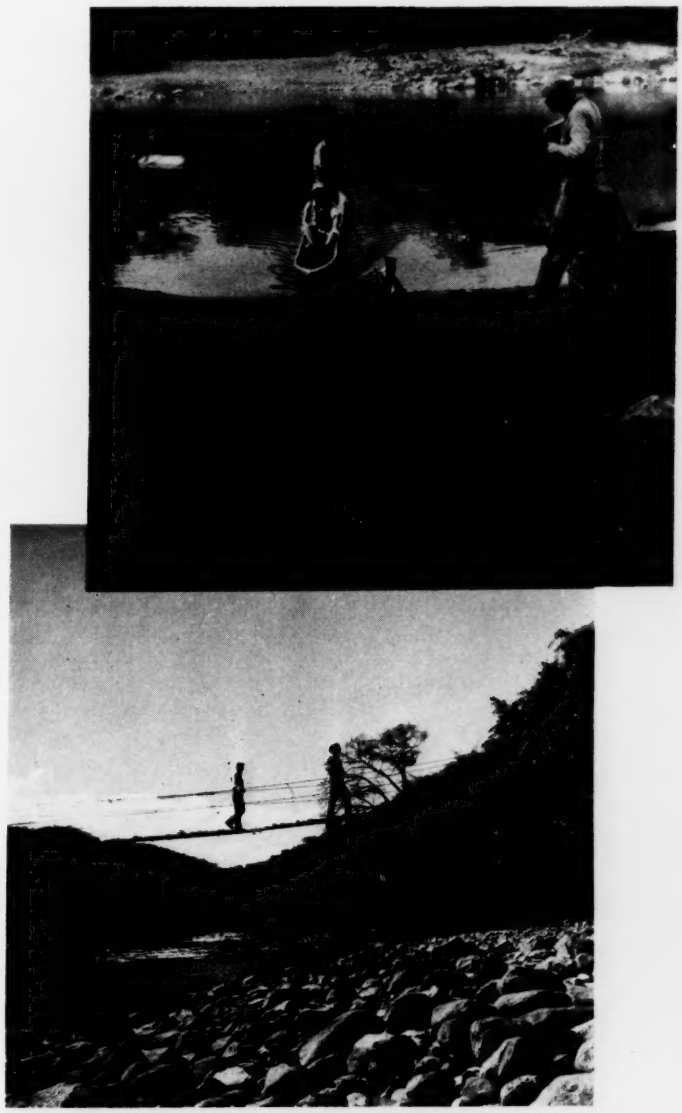
GERTRUDE DUBY

Indians where the investigators were going to study a landslide. We had found a guide who seemed somewhat imbecile, with a funny high-pitched voice, but we soon changed our opinion of him. He might have been completely at a loss in a city but was splendid on the trail. He pointed out the bad spots helpfully and knew his way.

The first part lead through exuberant tropical growth. Huitiupan, the village of the Río Ancora, was at fiesta, the men dressed in immaculate white. We crossed the river a little farther up at a beautiful spot. The water is deep, and bluer than the sky. An Indian came over in a dugout to take us and the load to the other side. He and some of his friends were sitting in the shade making a basket to catch crabs in the river. Their colony, Santa Catarina, was a few minutes from the crossing place, high on a cliff above the river, and after some difficulties we found the man who had the key to the school house which was to be our sleeping quarters. The two from Berkeley were to continue on to the slide and the opinions on how far it was were as many as the people present. I was to stay and get food ready and organize camp.

As in most Indian towns, I met first a solid wall of distrust and unwillingness to coöperate. Breaking this down at length, I found a family willing to make us a dinner of boiled chicken, beans, tortillas, eggs, and coffee. When those who had gone to the fiesta in Huitiupan came back, people gathered around the school house and soon a very friendly atmosphere was created and we got more food than we could eat.

When the sun slipped behind the high surrounding mountains and no one had come back from the slide I got a little worried. Night closes in fast in this part of the world. I was just going up the trail to look when I heard them coming. They were sweaty and tired, but satisfied. It was very far, almost two hours each way, and little funny Lauriano had first got lost, but later made up for it by finding amber in the moun-



The amber trail leads across many rivers.

The village of Santa Catarina, Chiapas.

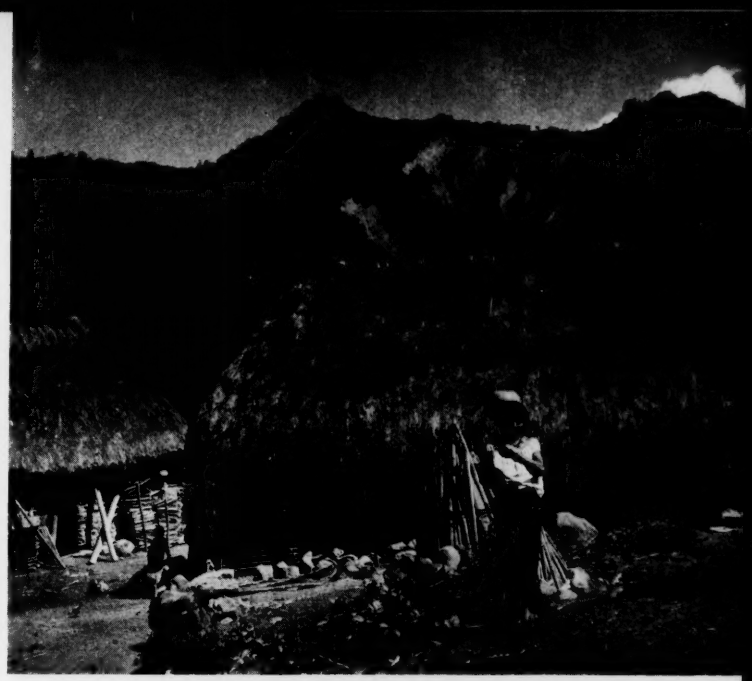
tain slide. After our ample meal we were glad to hit our sleeping bags.

The trail to our next stop, the coffee plantation El Xoc, we were told, was bad. A good thing the country was so beautiful – it made us forget a little that the trail was even worse than expected as we climbed for over an hour through a steep old tropical forest with huge trees which never let the sun through. The first to dismount was Wyatt Durham. He felt sorry for the mule which had to carry his 100 kilos, and he inquired at a stop how much, as a rule, could that mule carry. Antonio informed him that on a good trail it could take coffee sacks of 130 kilos. Durham seemed relieved but still walked a lot. After the highest point was reached, the trail kept us going endlessly and in kneedeep mud. We all decided to walk rather than to break our necks at the really terrible spots where the mules slid down the way people would on snow.

At two in the afternoon we reached a good-sized plantation, after six hours on the go, in mud most of the time, looking like pigs coming out of a mud bath. We were tired, hungry, and thirsty. The German administrator, Mr. Serr, and his young son treated us in the best tradition of hospitality, furnishing us with baths and a very good dinner.

We set out briskly next morning, not knowing what a heavy day lay ahead. The trail was easy and lovely till the branch off to the airfield of Sabanilla, which exists only to fly coffee out of this region. On the shore of a wide river we crossed sat a tall, dark boy, Juan Jimenez, who was going to take us on the shortest trail to Jolpabuchil, which means "head of amber." Every trail in the region between Simojovel and Yajalon goes straight up to the top of the mountain, and just as much down on the other side. It would not be so bad if there were just a mountain a day, but that day we seemed to climb the mountains of the whole mountainous state of Chiapas. We had the most gorgeous views over the land. We would look deep into valleys and see one mountain chain behind the other till they were lost in blue haze. And we trotted through a tropical forest full of bromelias and orchids.

Durham and Hurd are terrific walkers, only their method is not mine. A trained alpinist starts slowly, goes steady, and should be able to run at the end of the trip. Those two ran, stopped, ran, stopped, sweating and panting, holding out toughly. It seemed exhausting to me. Between panting and wiping the sweat from his brow, Wyatt would go into geological explanations, showing Paul a plant which actually should not grow near such kinds of stones, making remarks about a curious fossil, banging his pick on rocks, pick-



Amber deposits are exposed by landslides like this at Santa Lucia.

ing things up along the trail. Antonio the chief muleteer watched baffled; Pancho did not care. He thought probably those fellows must be crazy picking stones up and loading the mules down with them. All that pep was not reduced when Durham's mule fell and he was thrown onto hard rock.

We rode that day from tropical forest up to pine and oak, down again into the hot land. Our guide had no notion of time or distance – at least not our notion. Asked how far it still might be, he would declare it is just a league more, which could mean anything between one and five hours. Hours it was before Jolpabuchil that we saw the imposing mountain Ajcabalná ("the house of the god of the night"). It soars up from Jolpabuchil to 2,000 meters, its crest hidden most of the time in moving clouds. Ajcabalná seems to have been the center of the earthquake of 1952.

Nine hours were we on the trail when we rode into Jolpabuchil and the open arms of the administrator, Jesus Bermudez and his numerous family. The earthquake had completely destroyed the farm and only the most necessary structures had been rebuilt to now – the *beneficio* or coffee treating plant, and the cement floors for coffee bean drying and warehouse. The family had a room there and gave us space between high-piled coffee sacks. A good meal and river bath brought back our strength.

Ajcabalná dominates a gorgeous valley where two rivers join. The mountains around are heavily clad with tropical forest. In the early mornings, light mists rise up on the steep wooded flanks, little rosy clouds hang on Ajcabalná's shoulders. At midday heavy white clouds move around its head and at sunset a crimson glow spreads over the tremendous rock.

Wyatt and Paul went early to the amber slide in the river flowing from Ajcabalná. They were busily digging, scratching, photographing, making notes about the formation, and collecting fossils, but gladly accepted some juicy oranges I brought from the ranch.

Finding amber in the landslide at Simojovel.

Amber is where you find it: in landslides, as at Simojovel (ABOVE) —or in necklaces like this one worn by an Indian girl at Santa Lucia.

Jolpabuchil is rich with tropical vegetation. The heat is not excessive, two clear streams join to make the land a peninsula, beautiful mountains shut the plantation out from the world beyond. I did not mind waiting for the two investigators to come back from the slide for dinner.

They came very late. Everybody was starving, when they arrived with faces like the setting sun – all smiles. They acted very mysteriously until they unwrapped a beautiful piece of amber Wyatt found. Our host Don Chus was slightly vexed – he'd had a choice piece for sale and got a good price. It had cost him lots of work and many days to find it, and now those "gringos" dropped in to find in one day, with apparent ease, almost as big a piece. He must have wondered where we burned so many candles to be so fortunate! The local amber diggers, before they go to work, burn many candles to their favorite saint. If they find a tiny piece they put it back into the earth so it may grow bigger.

Leaving Jolpabuchil, we had for once an easy trail, going on the side of the mountain. Entering the busy coffee center Yajalon after some four hours of riding, we decided to have a quick lunch in the little restaurant. On the street I met the dashing young owner of San José Inapila, our ranch stop for that night. I was sorry to hear he slept at the *beneficio,* but he explained how I could break into the house through a back door. He was slim, tall, dark, with flashing teeth, his charro suit clung to his athletic body, a huge hat shaded his handsome face. He made a fine figure on his splendid mule.

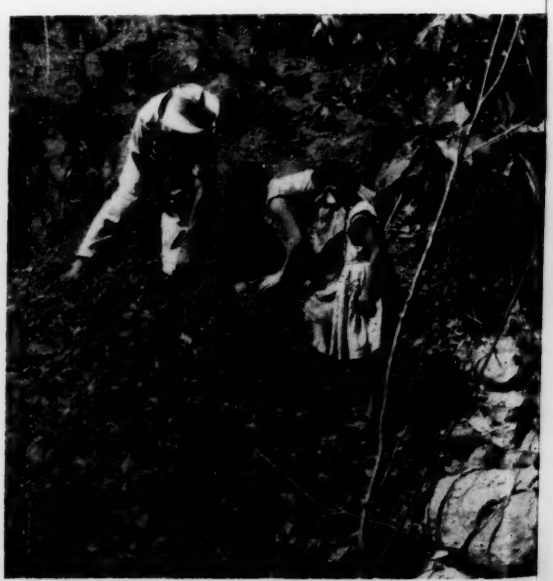
The climb from Yajalon was not only steep and hot, it was endless. Our poor animals were dead tired. But now, I think even Antonio knew some geological terms – Pleistocene, Eocene, sinkhole; we both knew Hurd's favorite bug. Antonio spotted a beautiful specimen of a wasp which carries the pompous name of tarantula hawk, genus *Pepsis.* The two, Antonio and Paul, chased the poor thing down with hats and sticks, finally ending under the legs of the mule which did not kick because it was much too tired for the extra effort. They got it. I am sure Antonio could never understand how grown men could get so excited about such a common "bug" like this wasp.

It was getting late when we neared San José. Twelve long hours on the trail, we were weary when we reached the closed ranch but we climbed the fence and broke into the empty house. Last time I was here Ricardo and his efficient servant received us like kings. He had in the meantime fixed a lot of the earthquake damage, but now he had been away, no woman was around, and the place was an awful mess. We made it as comfortable as we could, built a fire in the kitchen, and cooked the food we'd brought from Yajalon. It was pitch dark when Ricardo turned up with more food from the *beneficio,* and we had to make polite conversation when we really wanted to go to sleep.

Next day brought us the most varied trail of the expedition, through beautiful oak and pine forests, fording mountain rivers, and passing a huge coffee plantation, the bushes loaded with the ripe red berries. Then we went up and down strange landscape, from hill to sinkhole, in seemingly endless repetition. A curious behavior of the forest was very noticeable this year. We rode down from a hill with fresh green

Happy hunter — Professor Durham has just come into possession of a prize amber piece—

—Like this one turned up by some young searchers at Jolpabuchil.



vegetation to find at the bottom of the sink all the bushes frostburned. The two scientists had a big discussion about the phenomenon. Durham said the cold air concentrated in these sinkholes and could not get out. The effect was heavy frost.

The trail down to the Indian colony Aurora was really not fit for mules. We dismounted. Luckily the cargo mules were not too heavily loaded. From Aurora to Santa Lucia I got very confused. I feared I'd lost the trail until I realized the Indians had cut a lot of forest since my last visit, and high mountains were visible now which trees had once hidden. It is appalling to see what even a small population can do in the way of forest destruction. For a new cornfield, they clear and burn – and topsoil washes down those steep mountainsides. A new clearing is needed, and so on, until most trees have vanished.

The two from Berkeley had another landslide to investigate in Santa Lucia, a small Indian village. I was sorry for them as the heat was oppressive. Antonio and I and the pack mules went ahead to Santo Domingo, a big well kept ranch on the Ancora. We were glad to see again the cheerful blue river. It also meant that we had those steep mountain trails behind us. Doña Mercedes del Carpio quickly showed us a clean and friendly guest room. Many of those back country ranches take the place of a hotel.

It was dark when Wyatt and Paul arrived. We had a kerosene lamp on the table covered with a clean cloth and were served a good dinner. Insects were buzzing around the light. From now on I have to think of them as *Aedes, Anopheles,* or *Culex,* and see them full of evil powers. Hurd is to blame for that. They had been just simple little bugs until the entomologist from Berkeley messed things up. It is like the beautiful green rock we saw on the trail: it is now volcanic tufa with some copper, and has lost much of its charm.

We had a chat with Constancio del Carpio, owner of the place. He told us of some ruins nearby where they found some lovely objects which have since unfortunately vanished. He also knew another landslide with amber. Nobody seems to have explored it. The mountain is called Balumtun ("Stone of the tiger"). The Indians are afraid to go there – the mountain, they say, "*tiene dueño,*" has an owner; spirits throw stones at anyone coming near.

Simojovel greeted us next midday. We felt good, thinking all hardships were over. The field work was done – but not the hardships.

With the agreeable feeling of having just a few leisurely hours on horseback, we set out from Simojovel to a place called San Juan del Bosque, from which in a few hours by car we could reach San Cristóbal Las Casas on the Chiapas highland. The muleteers woke me at 2:30 A.M. and I went to get a woman out of bed who had promised to make us some breakfast. It was still night when our animals, now heavily loaded with rocks from many places, clattered over the cobblestones of the sleeping town. The moon was shining brightly, the banana trees were silvery, strange perfumes were in the air. Soon the dawn light drowned the moon, the mountains became sharp lines and once more we saw the giant Ajcabalná, the sky a dramatic crimson behind its powerful outline. Even so our mercilessly wornout animals began to trot more briskly – they also knew the trail was pointing home.

We'd made a good distance when we heard the unusual noise of a motor. A little while before we had heard the detonation of dynamite. When we reached the construction point of the highway to Simojovel, we knew we were in for it. Two big trucks and a pickup were lined up before what had been a very bad dirt road but was now a moving mountain, sliding into a terrific ravine. A caterpillar tractor was working hard on the other side to clear tons of earth and rock away. It would take hours to open enough even for people to pass. I felt awful. The Californians had to take a plane from Tuxtla Gutiérrez. I thought we should have taken a chance with a bush plane at Simojovel. The whole trip had been a terrible rush, every hour planned – now the last day things were going wrong.

Geologist Durham reads the earth's past in the rocks for entomologist Hurd.

Our heroes return to the present—San Cristóbal Las Casas.

We began to negotiate with the owner of the pickup to take us to San Cristóbal as soon as the road was open. From the start I didn't like the fellow, one of the mestizos who squeeze into Indian towns and take over everything which can bring in money. But we couldn't be choosy. The fellow would not commit himself and flatly refused to state his price. Fed up with this, we talked it over and decided Paul and I should try to get over the mountain to San Juan. I asked Antonio for my machete and explained what we were going to do. The pickup owner – "Fat Pighead" Paul had named him – stood nearby and said unasked, "You will never do it. Not even an Indian can get over that precipice, and even if you could you will not find a single car in San Juan." That was incentive enough to succeed! Wyatt, who speaks Spanish quite well, was to stay at the road to take action as soon as passage was possible.

It was blazing hot as we set out, Paul with a camera, I with a bag and my good old machete. First off we found a tiny trail climbing almost vertically to an even steeper cornfield planted not long ago and surely by acrobats. The hard dry soil was slippery as ice; there was nothing to hold on to. Far down on the road we saw active figures – the biggest, Durham, watched our slow move. We had to climb on all fours digging hands and feet into the soil. It was vital to avoid sliding, which would have landed us where we started. My bag was a great nuisance, taking me off balance. Paul gallantly offered to carry it, but he had the camera and I stuck to my bag. At the end of that vertical cornfield we landed in the most awful brush full of spiny plants. Here my machete came handy, but I used it sparingly as it was hard to cut and hold on at the same time. Paul was choking all the way up, but declared he wouldn't have missed the experience for anything. We had some discussion about the way: I wanted to cut brush on our level but Paul thought we should go higher. He was right, as we saw later. We'd have had a terrible cutting job, my way. I cursed the wasteful agricultural system, clearing slopes where never a tree should be cut.

When we turned the edge of the mountain, I couldn't help a joyful yell. At some 200 meters was a little coffee grove in clear, high forest – and people. A trail must go from there to San Juan. We still had some heavy going in thick brush with invisible holes where we dropped into thorn tangles. At last we reached the fine-looking Indians who peered at us as if we were ghosts. One man finally asked, "From where, by God, do you come?" We explained. They stared again, shook their heads, and broke out in violent Spanish swearing, but they'd seen the direction from which we came and had to believe us. They put us on the trail to San Juan – a lovely trail through fragrant pine forest.

Soon we saw our goal lying snugly far below. Only now did we realize how high we'd climbed. We descended quickly, I dreaming of coffee, Paul of cold beer. We dropped into a not too clean restaurant and sat in a welcome drafty place from which we could watch the road. We both had our disappointments: the only beer was warm, the coffee abominable. But after all poor Wyatt, out at the landslide, didn't even have water.

San Juan had been a charming town of Tzotzil Indians, with thatched houses, a little white church on a hill, a huge ceiba tree shading the plaza; but lately civilization had considerably spoiled it. The Tuxtla road, now going to Simojovel, had changed the sleepy Indian village to a busy center. Shops and bars had opened, loudspeakers ruined the peaceful silence. But "Fat Pighead" seemed to have been right in one thing – no car in town. The helpful village secretary dispatched an Indian policeman with a message for Wyatt.

Suddenly I spotted a taxi. We dashed out and at once arranged a ride to the road construction then on to San Cristóbal. The price was okay.

When we reached the point opposite the slide, the tractor stopped a moment and Wyatt came over the tumbling blocks and moving earth with the agility that always astonished me in so huge a man. "Fat Pighead" stared in cold fury – we'd made it, and come back with a car! The kind foreman stopped work and had his men help us over the rubble with our gear. On our way, we asked the driver of the broken-down old taxi if he thought it would make San Cristóbal. "*Si dios quiere*" (if God wishes), he replied. After much boiling and stopping for water we reached Na Bolom at last. Frans had a huge dinner for us, after which we sat in the library and told him our adventures.

Wyatt Durham and Paul Hurd went home to tackle the job of studying the material they had collected – of learning what mysteries of past life the amber held and making them known for science. It will be most interesting to learn what they found.

Insect in amber—a book louse of the order Corrodentia (greatly enlarged—actual size is 3 mm., or 3/32 in.).

ARCTIC AMBER

ROBERT L. USINGER & RAY F. SMITH

THE STORY OF ARCTIC AMBER combines elements of geologic science and Eskimo history with a certain amount of sleuthing and a generous portion of good luck. Unlike the gold of the Klondike, Alaskan amber has no monetary appeal; but, because of the glimpses into the remote past provided by the plant and animal inclusions, it is of inestimable scientific value.

The story starts twenty years ago when Dr. G. Dallas Hanna, Curator of Geology at the California Academy of Sciences, mentioned in the course of a conversation that he had once seen a piece of amber on the shores of the Arctic Ocean. This chance remark was recalled when Admiral Colbert of the Arctic Institute of North America was discussing plans for the 1955 season at the Arctic Research Laboratory, Point Barrow, Alaska. The excellent facilities available at Barrow were not the least of the attractions. Geologists had established that most of the rocks on the Arctic Slope are of Cretaceous age and hence twice as old (some 60 million years) as most other amber deposits in the world. The Cretaceous was the end of the Age of Reptiles and saw great changes in plant and animal life including the establishment of most of the modern groups of insects. Also, ironically, it is the least known of the significant geological periods in the evolutionary history of insects. Of more general interest, the Cretaceous was a period of coal formation in the Arctic and the causes of climatic change at that time are but little understood. With these thoughts in mind, we applied for and got a research grant from the Arctic Institute of North America for the Arctic Amber project.

Before the start of field work in July, 1955, we gathered bits of information from many sources to augment the slender lead of 20 years ago. From the writings of 19th century explorers we learned that amber occurs in beds associated with lignite on the peninsula of Alaska, in the alluvium in the delta of the Yukon, in the vicinity of the Tertiary coal deposits on the Fox Islands.* It was also reported that natives collected it at Amber Bay, Alaska and sold it to Kodiak traders. Of great interest was the account of a small lake among the mountains of Unalaska that contains an amber-bearing island, Umnak. The natives spread a walrus skin between two boats at the foot of a steep bank and dislodge the earth, which falls upon the skin, and from this debris recover much amber.

John Murdoch reports that pieces of amber were used as amulets for success in whaling and also, by women, as ornaments, especially on the outer side of

*Dall, W. H., 1870, *Alaska and its Resources,* Sampson, Lowson and Marston, London, 625 pp.

The Arctic amber trail leads another University of California team by Eskimo sealskin boat up the Kuk River inlet from the Arctic Ocean village of Wainwright. Fore to aft: Junior Bodfish, Dr. Smith, Dr. Usinger, Wayne Bodfish.

The broad Colville carries the drainage of the Brooks Range to the Beaufort Sea. The amber hunters' tent can be seen at the Killik Bend of the river. Shallow-water riffles were a constant menace to our canvas-bottom boat.

the inner frock (i'lupa) and, curiously, attached to the inner girdle in front so as to hang down between the legs.*

Field notebooks in Geological Survey files gave us more recent information. The most detailed report stated that amber had been seen but not collected at Ninuluk Bluff near the Killik Bend of the Colville River about 50 miles upstream from Umiat. Other Geological Survey notes mentioned Kay Creek, a tributary of the Ikpikpuk River, the Oumalik River, and Maybe Creek, all on the Arctic slope between Pt. Barrow and the Brooks Range. From Maybe Creek a single small piece of amber was found in the collections in Washington and sent on loan.

As the word passed around that a search was to be made for amber, Eskimos at Barrow contributed facts and lore. Several pieces of amber were held by C. D. Brower at his store at Barrow Village. Pete Sovalik at the Barrow Laboratory remembered as a boy picking up amber on the beach at Smith Bay and an Eskimo from Wainwright said that there was a vein of amber on an exposed cliff 10 miles up the Ketik River. This last report led to a study of maps of the Kuk River inland from Wainwright. One of the rivers in this vicinity bears the name "Omalik" which is the word for amber in the Eskimo language.

The season for river exploration on the Arctic slope is very short, roughly from the middle of July to the end of August. Earlier, the ice breaks, making navigation impossible. We timed our arrival at Barrow accordingly, arriving on July 14. Flying over the Brooks Range and down the coastal plain, we observed that ice still covered many of the lakes but the rivers were clear. Also, the ice pack was only a few feet from shore at Barrow, but the beach in front of our quonset hut was clear. At the Arctic Research Laboratory we were quickly outfitted for work in the field. It was decided to concentrate our efforts in two regions, the Colville above Umiat and the Kuk inland from Wainwright, these appearing to be the most promising.

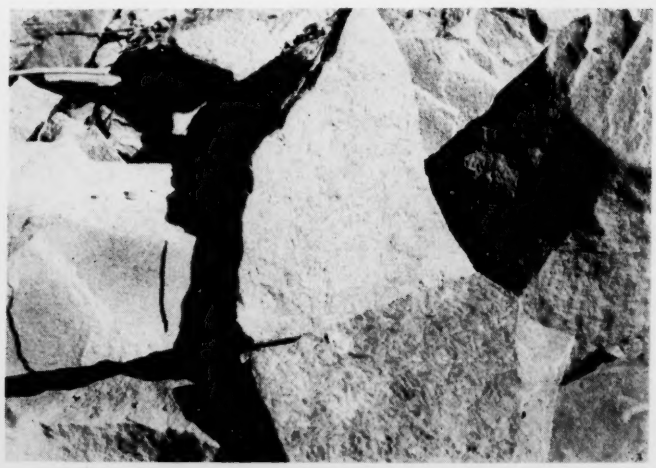
The Colville is smaller than the Yukon or the Mackenzie, but nevertheless is one of the great rivers of

*Ethnological Results of the Point Barrow Expedition *in* Powell, J. W., *Ninth Annual Report of the Bureau of Ethnology to the Secretary of the Smithsonian Institution 1887–1888,* Washington, D. C. pp. 1–441.

Close-up of our camp at the Killik Bend of the Colville, with amber bearing strata in the Ninuluk Bluff.

the North American continent. It traverses the Arctic slope in an east-west direction and empties into the Arctic Ocean at Harrison Bay. Over much of its course the channel is wide, with numerous oxbows and side branches. Flying upstream from Umiat in a little Cessna 180 float plane, we tried to memorize the ever-changing pattern of channels. Ray Smith was the first passenger and picked the mouth of the Oolamnagavik River as a camping spot. He unloaded the first lot of gear, including tent, sleeping bags, and boxes of C-rations. A second trip was necessary to carry the 16-foot folding canvas boat and the rest of the party, which included Phil Sovalik, an Eskimo boy from Barrow. Camp was made in the rain but still with adequate light from the near midnight sun.

The next morning, July 20, was clear. There were tracks of wolf in the soft sand outside our tent and a large moose and her calf were crossing the stream near



Professor Robert L. Usinger hunts for amber in tilted rock beds along the Colville River. The close-up (LEFT) contains amber inclusions in the rock.

Professor Usinger looking for amber in stratified beach drift. The waves sorted the different materials washed ashore, dropping first coal, then the lighter amber along with twigs, where the author's hand rests.

camp. Mosquitoes were so thick that several hundred could be seen on a man's back at one time, but they were avoided with head nets and repellents, except when it became necessary to perform one's toilet. It was uncomfortably hot amidst the willow thickets along the river, but a cool breeze refreshed us up on the tundra where we hiked to reconnoiter and catch a glimpse of the snow-covered peaks of the Brooks Range.

Along the steep bluffs we found veins of coal up to six feet thick and also harder gray lignite beds. Plant fossils were seen in sandstone above and below these and included recognizable leaves of *Metasequoia, Ginkgo,* and fossilized wood. Finding no amber, we decided to move downstream the next day.

The canvas boat was propelled by a 5 h.p. outboard motor. River navigation proved easy in the deep, swift channels but was unexpectedly difficult when the river fanned out into shallow riffles. At such times — they were frequent — the motor was useless. We learned to recognize the shallow danger areas where rocks could rip the canvas bottom off the boat. These spots occurred just *before* the rough water, and hence were deceptive. When running riffles, we were prepared at a moment's notice to go over the side in hip boots to lighten the load and hold the boat against the current while guiding it "over the hump" into deeper water. We stopped several times to explore coal beds and exposed banks, and finally at 10 P.M. saw the bluffs at Ninuluk, precisely as described in the Geological Survey notebooks.

Intensive work during the following days revealed amber in coal and harder lignite in the last of the tilted beds downstream on the south side of the Colville. The amber appeared in small pockets when the shales were split but it shattered or powdered when exposed, and hence it was of no value as a source of possible fossil inclusions. Other banks and coal veins were worked on the trip down stream to Umiat with little success. We saw coal fragments with pea-sized amber pockets on the gravel banks at Umiat, however, and found one larger, usable piece of amber in beach drift at Umiat.

The flight back to Barrow was uneventful, though the pilot tried three times before landing successfully through the fog at the Barrow airstrip. At the Laboratory we unpacked and studied the material collected on the partially successful first trip, and prepared for the second.

The Kuk River is a large inlet back of the Eskimo village of Wainwright. We flew by bush plane over the monument to Wiley Post and Will Rogers, and landed on the beach at Wainwright. An Eskimo sealskin boat with outboard was rented from Waldo Bodfish with the promise that his son would accompany us as soon as he returned from hunting walrus in the ice pack off the coast. Late the next evening we set out after a spectacular trek by sled (towed by a tractor) across the tundra to the inlet. This time our party consisted of four — Wayne Bodfish brought along his 12-year-old brother. The trip up the Kuk inlet was cold, overcast, and windy, with large waves breaking over our open boat. We pitched camp on the beach near "Coal Mine No. 3" at 10:30 P.M.

The next morning, clear and warm, showed us much beach drift including windrows of small coal and driftwood. By noon, Junior Bodfish had proved his worth as an amber hunter by finding two small pieces,

Beached and careened, the sealskin boat of our Eskimo guides was carefully cleaned and dried after each use.

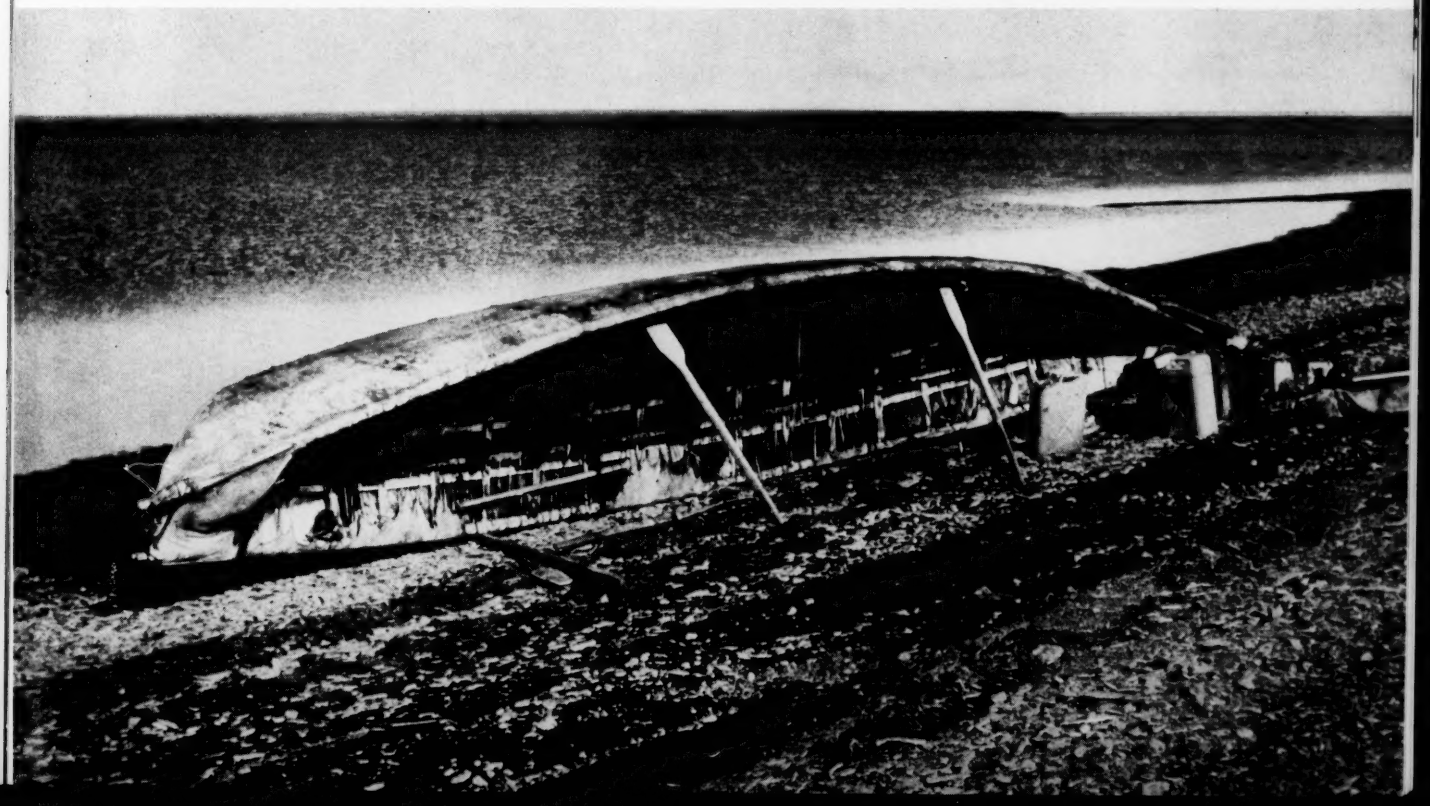
twice as many as the adults. After lunch and tea made by the Eskimos with water melted from a snow bank, we moved on to the beach just downstream from the mouth of the Omalik (Amber) River. As we landed, we began picking up amber of larger size, and by 6:30 P.M. had gathered hundreds of pieces of sizes up to 1.5 inches in diameter. Amber occurred in drifts for miles along these upper reaches of the Kuk, so we moved camp and gathered as many pieces as possible during the next few days. The best collecting was at the mouth of the Omalik and across the Kuk at the mouth of the Pugnik River. The Eskimos were productive amber seekers, but were no less valuable as caribou hunters, thus relieving the tiresome monotony of C-rations.

Still before us was the rumor heard at Barrow that amber occurred in a place in exposed veins "10 miles up the Ketik." Since the Ketik, the Kaolak, and the Avalik rivers enter at the head of the Kuk inlet, we shifted camp to this area, again finding amber abundant in the beach drift. Then, on a completely overcast day with strong winds (hence few mosquitoes), we started up the Ketik. With a channel hard to find through the sand bars, we were finally stopped completely and had to leave the boat behind. The 10-mile walk up the Ketik was shortened slightly by cutting up over the tundra to avoid oxbows, but nevertheless the hike was tiring in Arctic shoe-pacs.

At approximately 10 miles we made a special search for exposed "veins" of amber, but to no avail. It appeared that this lead was false, but we spent some time working an unusually large exposure of gray mud and shale along the right bank going up river. Here, from clay intermixed with coal veins as thin as ⅛ inch, we dug pieces of amber like those of the beach drift. Once recognized, these exposed bluffs proved to be common up and down the rivers, and hence are a widespread source of amber. Colonies of arctic ground squirrels were always associated with the upper parts of the exposures, and it is not yet clear whether they initiate the erosion or come in because of the exposed ground. The clay is nearly always marked by thousands of hoof prints, so caribou must also hasten erosion. Thus animal life and, no doubt, also the alternate freezing and thawing of ice cause a continual supply of amber to be washed down into the rivers whence it is carried by currents to be deposited in beach drift.

With amber found in abundance and its source located in bedrock of Cretaceous age, there remained only one question to be settled, namely, the presence of recognizable plant or animal fossils. Previous experience of Dr. F. M. Carpenter with Canadian amber indicated a ratio of only one productive piece in a thousand, so our chances were slim indeed. Nevertheless, we decided to devote a few minutes on our last night in the tent at Pugnik beach to searching with a hand lens. This proved to be the climax of a summer distinguished by singular good fortune. The first small piece we examined was clear and revealed six small wasps, so perfectly preserved they looked still alive with wings spread as in flight. These have since been studied and prove to be a new species, genus, and tribe of the family Eulophidae.

The rest of the amber and quantities collected during the summer of 1956 by Drs. Langenheim and Smiley, while dating the deposits more precisely, is now being examined for inclusions. Detailed reports will be published in appropriate scientific journals.



Where the Willows Bend

IF YOU'VE EVER paddled a canoe or drifted, idly, on the glassy surface of a slow flowing, willow-bowered stream, you will not forget the experience. Least of all, perhaps, will you forget the birds—their lively flight, their flashing color, their song.

I recall arching willow borders of Swan River where they curve to forest-girt Swan Lake in western Montana; Logan River's clear currents gliding between willow-alders in northern Utah; bowered banks of Wyoming's upper Snake; and willow-bound shores of Lower St. Mary's beyond Glacier Park. Will you ever forget the prairie streams purling under bending willows riverward beyond the Rockies? Or wide willow copses silver-green in the high, humid valley-basins of the mountains?

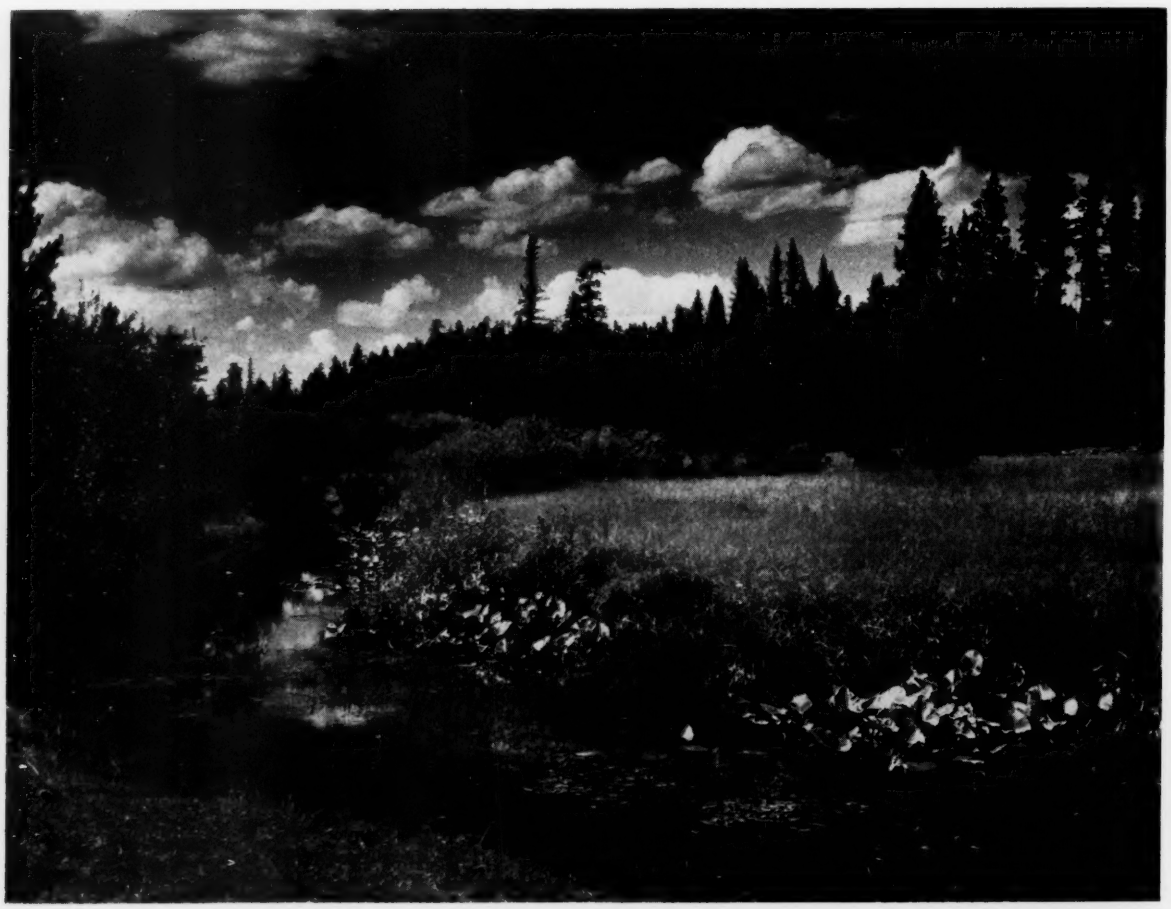
Studying the stream borders, the naturalist is as certain to be charmed by the habitat as by the birds.

Willows occur commonly as narrow belts along streams at nearly all altitudes, thus traversing nearly all life zones. The habitat broadens out in bottomlands, in mountain basins, and among the lower foothills. Chokecherry, silverberry, elder, osier, and thorn accompany the willows. Cottonwoods and quaking aspen mingle with its streamside cover. Low, dense tangles, intersected with open inviting aisles, provide a flourishing shrub-level cover.

Such characteristics attract birds adapted to short flights and leaf-gleaning in tangled coppices. From broad willow crowns, midget flycatchers snap up insects in their aerial dance over slow, winding waters. Ground foragers find brush cover and low, branchwork mazes to their liking. Crows and magpies discover suitable nest sites here in country that promises wider ranging. Many famous songsters have joined the list of willow-loving birds.

From the dense, shaded, California stream-bottom thickets, and from willow-osier-alders farther north, mellow overtures of the Swainson thrush fill summer evenings.

Like the Swainson thrush and veery, song sparrow,



Black-capped chickadee on canoe birch, northern Montana. Chickadees are confiding but exceedingly active subjects. This is a characteristic breeding species in willow habitat. (Sunlight, 1/200 at f.8. Fast Panchro-Press film, no filter. With cable release of camera.)

← Willow habitat, along a meadow stream, Lincoln County, northwestern Montana—headwaters of the Thompson River flowing from Lower Thompson Lake. Yellow pond lilies and sedges grow along the swamp banks.

catbird, and downy woodpecker, the black-capped chickadee is typical of streamside cover. His dulcet *sweet-spring* among the catkins sends winter from our creek banks. His bright eye beneath pulled-down cap, and jaunty *dee-dee-dee* are certain cheer at any season.

Where cottonwoods or hawthorn share the inner stream border, cedar waxwings often flock, their beady, sibilant notes and crested elegance demanding your attention.

Goldfinches, yellow and pileolated warblers dazzle as they dart above the bending willows or arrow across the stream. Black-headed grosbeaks roll out their rhapsody. Bell and warbling vireos sing from the shrub; spotted towhees noisily shuffle dry leaf-litter below.

Among characteristic western species of the Willow Habitat, we record the long-eared owl, Traill flycatcher, Brewer blackbird, Tolmie warbler and American redstart. The fox sparrow is there, we know from his lyric, and yellow-breasted chat and blue-hooded

(Continued on page 24)

STORY AND PICTURES BY **JOHN L. BLACKFORD**

Cedar waxwing—inner stream border, Granite Creek, northwestern Montana—a breeding species in willow-cottonwood-hawthorn or willow-cottonwood-conifer complex. The male has just fed his family of five on wild currants, but the mob is still hungry. (From hide, using trip-cord. Fotoflash, $\frac{1}{200}$ at f.32.)

Swainson thrush—western Montana, at nest in red-osier dogwood—a characteristic breeding species of the Willow Habitat, stream border and bottom and willow-birch-alder. (From blind. Fotoflash, 1/100 at f.16. Super Panchro-press film, no filter.)

Large, heavy steatite bowl, cracked in the making.

ISLE OF MINES

Clement W. Meighan

& Keith L. Johnson

CATALINA ISLAND today is just a vacation resort to the thousands of southern Californians who visit it each year—few of them know that Catalina was once the center of an aboriginal mining industry which shipped its products to a wide market on the mainland. The ancient mines and quarries, many of which are still clearly visible, have been recently studied in some detail by archeologists from the University of California (Los Angeles) who are engaged in a comprehensive study of the Indian remains on the island. Although the ancient mines of Catalina have long been known, the modern survey shows the mining activities to be much more extensive and varied than was previously realized.

Santa Catalina, 22 miles long, 76 square miles in area, lies just off the coast of southern California about 27 miles from Los Angeles Harbor. It is a rugged and mountainous island, inhabited in the interior mainly by wild goats, pigs, cattle and even some buffalo, all of which were introduced to the island by the early European settlers. The last of its aboriginal inhabitants were removed to the mainland in 1832, but at the time of the Spanish explorations the island was the home of two or three thousand Indians of the Shoshonean language family.

The Catalina Indians built houses of thatch and reeds and lived in small villages, each with its own chief. Their customs interested the Spanish explorers and missionaries, some of whom recorded their observations. The Indian culture contained a rich mythology associated with a religious cult which included drinking a narcotic drug made from jimson weed. Under the influence of the drug the Indians experienced visions and dreams of religious import.

Marriage among the Catalina Indians was by purchase, and prominent men might have more than one wife. A husband's authority over his wife was absolute; however, in cases of infidelity it is reported that the husband sometimes left his wife to her seducer and himself appropriated the latter's spouse.

The Catalina Indians lived mostly on the abundant sea life which surrounded their island. They caught fish with bone and shell fishhooks, hunted deer and small game with bow and arrow. Mussels and abalone were also common to their diet, which was further supplemented by seeds and other plant foods gathered

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(Continued from page 21)

lazuli bunting. Yellow-billed cuckoos haunt the deepest tangles. Saucy black-masked yellow-throats favor damper streamsides with wild rose borders and cattails from the shallows.

In the Southwest the little ladder-backed woodpecker interrupts his foraging across the cactus lands to nest in tree-willow groves along ephemeral streamways with desert elderberry and mesquite.

Bird watching or boating, you'll never forget these bright wings and bird songs where the willows bend!

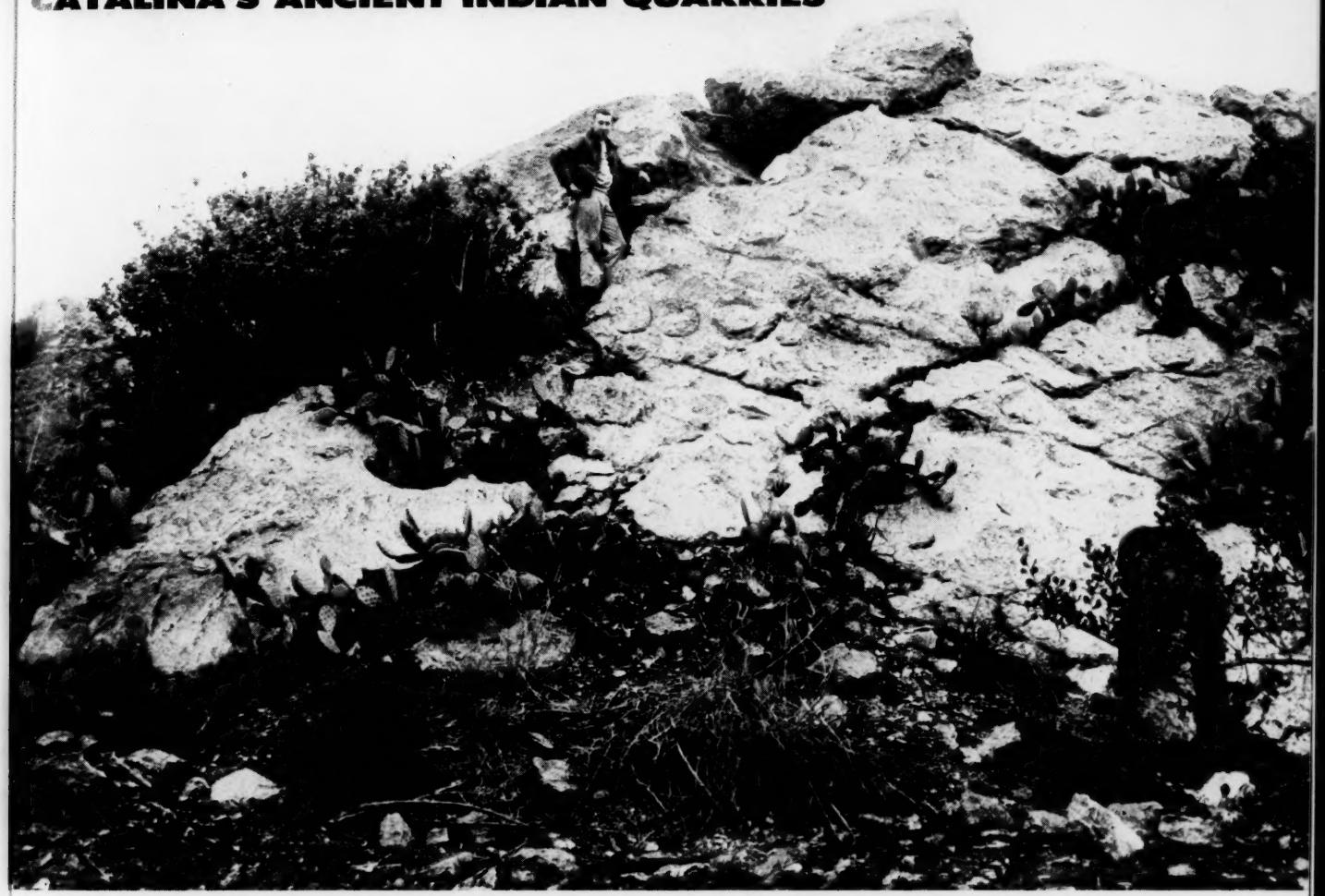
The Author's new book:

Western Wonderlands: *A Guide to Bird Habitats of the Western United States.* By John L. Blackford. Vantage Press Inc., New York. 1956. 120 pp., photo section of 96 plates, some line drawings. $5.00.

Readers of Roger Tory Peterson and James Fisher's *Wild America* will recall how the two bird-men in the course of 30,000 miles' travel in the U.S., Mexico, and Alaska "kept appointments" with certain birds in particular places. To do this they of course had to know in some detail both migration habits and habitats of the birds they "called on."

Our *PD* contributor John L. Blackford has supplied Western bird lovers with an "appointment book" for their bird neighbors. After an introductory discussion of Life Zones, Forest Layering (woodland birds are like people in apartment houses – some prefer the upper stories, some the middle, some the ground floor), Plant and Animal Succession (the repopulation of a fired area, the changing of pond to bog, etc. – much study remains to be done in this field), and Bird Habitats generally considered, *Western Wonderlands* goes into check-lists of the birds found in 18 different habitats – e.g., Sagebrush, Fresh-Water Marsh, Pacific Sea Beach – with a wealth of ecological detail for each and the birds listed according to breeding and non-breeding occurrence. The portfolio of some 150 photos (110 or more by the author, others by various top photographers) is exceptionally well printed and is alone worth the price of the book, which is sure to find its way into many a bird-watcher's kit bag or window shelf. D.G.K.

CATALINA'S ANCIENT INDIAN QUARRIES



Steatite boulder with scars showing where more than 80 large bowls were chiseled out.

on the island or traded for. Travel to and from the mainland was by canoes—large craft, of wooden planks held together by cords and waterproofed with asphaltum, which could hold 8 or 10 people.

Early Spanish visitors to Catalina didn't mention the mining industry, but it was nonetheless remarkable for an aboriginal people. The modern conception of California mining includes primarily valuable metals, particularly gold which has been so important in California history. However, the Indians of the state never used metals of any kind, so the wealth of gold which was under their feet never meant anything to them. Catalina Island, although not in the Mother Lode country, experienced its own short-lived "gold rush" in the 1860's. The island later proved to be productive of silver, lead, and zinc, which were mined for several years until the veins were worked out. The prehistoric people did not mine and quarry these metals, however, but certain raw materials which had a widespread importance to Indian technology. These included:

1. Steatite or soapstone, a soft mineral which can be scratched with the fingernail and was easily shaped with stone implements.

2. A hard blue slate, pieces of which were used for making chisels and chopping tools. Such tools seem to have been intended almost exclusively for working steatite; they are mining tools which do not occur in Indian village sites on the mainland.

3. White quartz cobbles, for hammers and choppers. Again, these were not export products but were spread over the island for local use.

Bowl blanks shaped on a steatite boulder.

4. Red ocher, a natural red pigment, for painting some of the steatite objects to enhance their appearance; no doubt it also served widely as body paint. Since red ocher is fairly common, it is not known for sure whether Catalina's red ocher was traded to the mainland. However, the purity and brilliant red color of the Catalina pigment suggests that it was valuable enough to be sent to the mainland for trade along with the steatite found in the same location.

Most of the primitive mining of the Catalina Indians was carried on in the center of the island in the general region of the modern airport. It is only in this region that the soapstone is found, and quarrying activities of all kinds were concentrated in the same zone.

Far and away the most important resource of the Catalina Indians was the soapstone, with a quality and quantity not found elsewhere in southern California. Virtually every steatite outcrop on the island, even including almost-buried boulders only three feet or so in diameter, shows the signs of aboriginal working. An intensive search of a small area carried out by Fred Reiss, an employee of the Santa Catalina Island Company, has shown dozens of such outcrops worked by the Indians, often within only a few yards of one another.

The main objective of the ancient miners was to hack out large rounded blocks which could then be hollowed out to form bowls, plates, and globular vessels. Smaller pieces of soapstone, including the waste from making bowls, were turned into such objects as effigies of whales, grooved stones for straightening and smoothing arrow shafts, pendants, and beads. The larger flat pieces were turned into *comals,* a sort of griddle on which food could be cooked. Examples of all these objects occur widely on all the other southern California islands and on the mainland from Santa Barbara County to San Diego County. Bowls turn up now and then hundreds of miles inland. Nearly all of the steatite objects in southern California archeology appear to be derived from the Catalina quarries. Also, nearly all of them must have been shipped from Catalina finished, for little waste steatite is found elsewhere and the ground is covered with reject and half-finished pieces around the Catalina quarries.

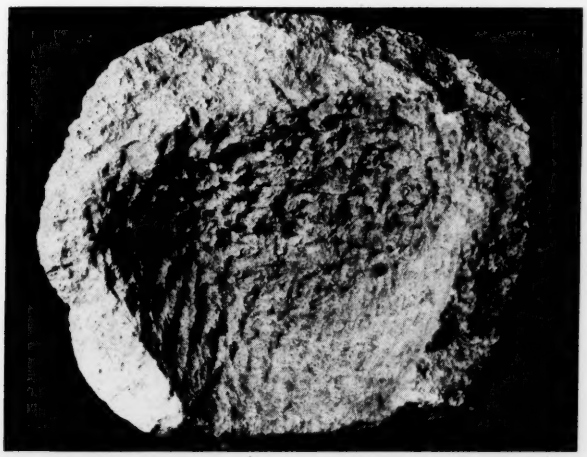
The emphasis upon bowl manufacture obviously rests on certain qualities of the steatite and on the culture the aborigines of the region possessed. The coastal Indians had no pottery and no cooking vessels which could be placed directly over a fire. Instead, they cooked much of their food by stone-boiling, dropping hot stones into water-tight baskets of food. Although this worked very effectively, the Indians

must have seen the advantages of a pot which could be placed directly in the fire and the steatite bowls served this purpose well. Steatite as a raw material has two major advantages—it is soft and easily worked, and it does not split or break when it is placed in a fire. Here was the soapstone, there was the desire

Excavating one of Catalina's oldest Indian villages. Although the source of steatite is only a couple of miles away, virtually no objects of this material turned up here.

for fireproof cooking utensils—result: a thriving soapstone bowl industry.

The larger outcrops of steatite on Catalina Island are covered with scars and shallow pits showing where bowl blanks were removed. The biggest outcrop has more than 80 large bowl scars now visible. The face of the stone seems to have been worked over its entire surface, and then a second layer of bowls was dug out. We can't be sure how much steatite has been dug away, but some of the partly worked outcrops



seem to have been originally some 3 to 5 feet thicker.

The Indian quarries were active when the Spanish explorers landed, and from the finding of old-fashioned iron axe-heads near some of the quarries it looks as if the mining continued into early historic times. All such work ended abruptly with the removal of most of the Indians to the Spanish missions, and the subsequent disappearance of Indian culture. Since the quarries were abandoned suddenly, they reveal bowl manufacture in all its stages, from beginning point to finished project. This is lucky for the archeologist—he can reconstruct the primitive mining techniques in considerable detail.

Stone bowls were quarried mainly in two ways. For ledges and outcrops with a flat surface, the Indian miner began by cutting a circle of the proper size on the rock face. Then, with stone chisels, gouges, and picks, he cut downward and inward to isolate a block of steatite. As soon as he could, he broke off the block, leaving a stem in the cavity. The blank was hollowed out with stone chisels, smoothed with abrading stones (often to a remarkable degree of thinness and symmetry)—and the finished product was ready for a trading expedition. On some outcrops natural projections were frequently shaped into a rough bowl form and then undercut by the most convenient method. The bowl was not finished until the blank was detached, however, whichever way it was begun.

Not infrequently the block of soapstone broke in the working, while still attached to the native bedrock, or after the bowl was partially hollowed out. Hundreds of fragmentary and unfinished bowls have been found, including several bowl blanks which split neatly in two just as the Indian artisan began to hollow them out. Sometimes the breakage was due to a natural fault in the steatite; at other times, the workman's too vigorous chopping. In either case, it's not unlikely that the air was full of Indian profanity when the piece broke, for many hours had already been spent in the laborious task of cutting out the bowl blank.

Although dozens of outcrops show the effects of Indian bowl-making, it is apparent that the surface rock was not enough to handle the mining industry, and there are many indications of open-pit mining where the Indians dug holes to get at the sub-surface ledges and veins of soapstone. The biggest of these pits today is perhaps 40 feet in diameter and 3 or 4 feet deep; however, all of the pits have had soil washing into them for at least 150 years, and they must have been somewhat larger and perhaps much deeper when they were in use. The pits are all at the base of surface outcrops and they are obviously intended to expose more rock surface for mining. Although none

↑ Broken steatite bowl showing inside pick and chisel marks of the shaping process.
→ This bowl split in two at the beginning of the hollowing-out process.

of the pits are large by modern mining standards, the fact that there are dozens, perhaps hundreds, of such pits is clear evidence of intensive working of the steatite by fairly large numbers of miners. Today, the pits provide a particularly favorable spot for the growth of a native cactus common on the island, which makes exploring the old mines hard. One such pit, less overgrown than most, has been partly excavated, however. The soil was full of steatite fragments, mostly showing the marks of stone tools. Bowl scars were found beneath the present ground level, and the pit also yielded a few of the crude mining tools made of slate and quartz.

A crucial question now being attacked is, when were the Catalina Indian mines first worked? If the remains now visible represent thousands of years of quarrying, then we need not think of this as an industry of any great size. On the other hand, if all this steatite working was concentrated into a relatively short time, then we must propose a surprisingly large commercial enterprise for the aborigines. This latter explanation seems correct, for the oldest Indian sites in southern California have no steatite objects at all. Sites of an intermediate age have a few steatite objects, but it is in the late protohistoric villages that these artifacts are found in real abundance. Since the dating of prehistoric villages is quite difficult, we cannot yet be sure of a precise beginning date for the steatite industry. However, it appears that its peak came in the few centuries just before the Spanish discovery. From this we conclude that the Catalina Indians were systematically exploiting their monopoly on the steatite quarries, that they must have spent much of their time in manufacturing soapstone objects, and that a fairly elaborate marketing and trading system must have existed to distribute the finished utensils. Unfortunately, we do not know what the Catalina Indians were getting in this trade. Nothing

This 4-inch steatite whale decorated with shell beads set in asphaltum was found on San Nicolas Island but the material was quarried on Santa Catalina.

A large slate pick used to chop out steatite bowl blanks. Actual length about 11 in.

Small pieces of steatite showing the aboriginal shaping for various purposes. The grooved piece at left was used for smoothing arrow shafts.

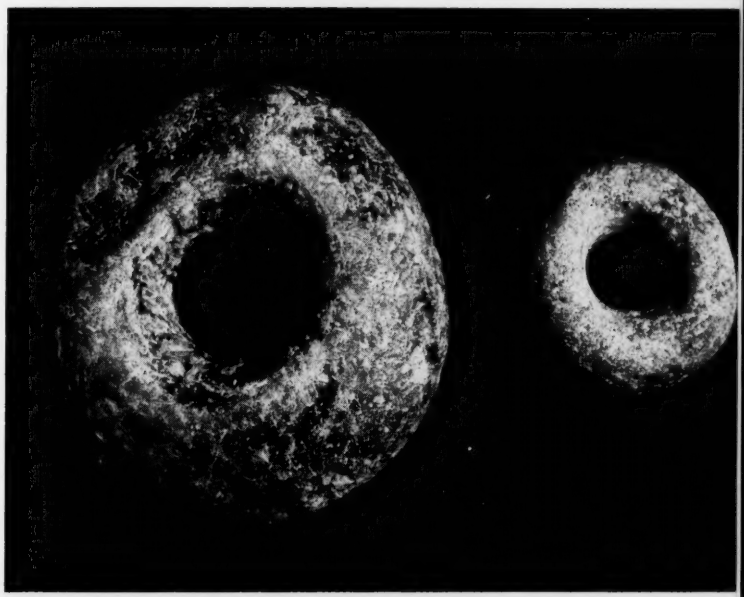
Steatite canoe a few inches long found in a construction excavation at Avalon. Now in the Santa Catalina Island Museum.

tangible has been recovered in the current archeology project that can be surely identified as coming from the mainland. It seems likely that the steatite was being traded for some sort of perishable goods, perhaps seeds and other food supplies.

In contrast to the production of steatite artifacts, the lesser mining and quarrying activities of the Catalina people were intended mostly to satisfy local demands. A great many stone tools were necessary to supply the workmen quarrying steatite. The preferred material was a hard blue slate, obtained from outcropping ledges which overlook some of the steatite quarries. Smaller pieces of slate could be simply picked up from the surface of the ground. A crudely sharpened edge was made by chipping the slate with another stone, and the tool was ready to use. Larger tools, such as the big pick illustrated, probably had to be made of slate fragments which were themselves mined by being split out of the ledges. The breakage on slate mining tools was evidently very high, since pieces of such choppers and scrapers are quite numerous near the soapstone workings.

Quartz was also a raw material the Catalina aborigines used. Because of its hardness and resistance to breakage, the stone was good for making hammers, some of which were used in the steatite mines. Since quartz is too hard a material to be readily quarried with tools the Indians had, they relied upon fist-sized pieces found on the surface of the ground. There are two small areas of Catalina where such pieces are abundant, weathering from larger quartz boulders. Artifacts found at these spots show that the Indians were familiar with the quartz locations and visited them specifically to gather stones of the proper sort for tool use.

Finally, the mining of red ocher as a mineral paint is worth mention. In one place a bright red pigment can be found at the surface; the presence of seashells and stone tools attests the visits of the Indians to this location. The red ore is soft and could be easily scraped into baskets or other containers. At least some of the red paint was used for coloring the outside of small steatite bowls, for such decorated examples of Catalina steatite are found throughout southern California.



Perforated pieces of steatite used for weights on digging sticks. The largest one is 4 inches in diameter.

Steatite object, possibly a stylized pelican. Length 6 in. In the Santa Catalina Island Museum, Avalon.

It is apparent that the former Indians of southern California were well aware of the natural resources of their environment. Those raw materials which fit the needs of the people were systematically sought and exploited, and one can hardly fail to be impressed by the ingenuity and industry of these ancient miners.

By land and by sea

Men to Match My Mountains: *The Opening of the Far West, 1840–1900.* By Irving Stone. Mainstream of America Series. Doubleday & Company, Inc., Garden City, New York. 1956. 459 pp., endpaper maps. $5.95.

The story under Irving Stone's alliterative title is one that has been told, and told, and told again, more often thread by thread (or yarn by yarn) than in the full woven fabric of robust texture and lively color. Robust and lively indeed are both content and style of *M. to M.M.M.* The style is often as fresh and free of dignity as today's paper. Of events at Monterey in 1842:

"Commodore Jones was happy that the conquest had been bloodless. His happiness was short-lived. Thomas Larkin showed the commodore recent newspapers and commercial letters from Mexico, proving that Mexico and the United States were waging a cold war rather than a hot war.

" 'This change in the aspect of international affairs called for prompt action on my part,' cried Commodore Jones [to his journal?]. To the Californios he said, in effect:

" 'Oops, sorry!' "

The quotation may suggest, not erroneously, that for all its jumbo size, and small-type pages both wide and deep, Mr. Stone's contribution to a popular series is as easily and rapidly read as one of our lighter historical novels. If this assures its being read — good! It will help counteract what too often looks like an appalling stock-shortage in the history department of the popular mind.

Not to quibble over a mere subtitle, the definition of Far West here adopted seems a bit narrow: "the present-day states of California, Nevada, Utah and Colorado [comprise] the area designated by geographers as the Far West." The reviewer has (wrongly, it seems) always thought of Oregon and Washington as Far West, if not also Arizona, and perhaps more loosely Idaho, Montana, and Wyoming. But perhaps these actually not so vital distinctions remain to be settled among both geographers and historians.

Empire on the Pacific: *A Study in American Continental Expansion.* By Norman A. Graebner. The Ronald Press Company, New York. 1955. ix + 278 pp., maps. $4.50.

No more different approach to history, nor less like the foregoing in style of presentation, could be imagined than this study by Norman A. Graebner. A professor of history, the author of *Empire on the Pacific* explores the rôle of seaports in bringing Americans to the Pacific Coast, to stay. He finds ports the crucial factor in American commercial and ultimately territorial expansion. Dealing with the '40's, he analyzes very critically the Polk administration and its opposition, with respect to the Oregon question and the Mexican War. The factor of American public opinion and the press is dwelt upon. There is a highly illuminating account of the Trist Mission. The whole is set against a sharply sketched background picture of Californian life and times just before the Gold Rush.

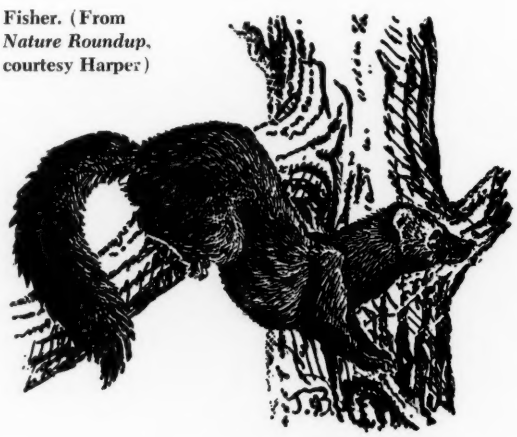
Pacific southwest

To the Great Southern Sea. By William Albert Robinson. Harcourt, Brace and Company, New York. 1956. xxi + 230 pp., 20 photos, 4 plans, endpaper charts. $5.00.

On February 25 this year *Life* began a new series, "Great Adventures," with the "Romantic Voyage of the 'Varua' — a brigantine in the South Seas encounters beauty and dangers. . . ." With the beauty of islands went perhaps some peril of reef, some latent hostility of islanders to mark the voyage from Tahiti through Melanesia to Siam. Quite different was *Varua's* earlier sailing *To the Great Southern Sea,* south and east from Tahiti, beyond Rapa, beyond all islands, men, ships, and help, south to 50° and running her easting down through the Roaring Forties to Patagonia.

She was Robinson's dream ship which he conceived and built in his own New England yard. She carried him, his lovely Tahitian bride Ah You and their unborn child, two Polynesian seamen, and 11-year-old Piho — she came to them from Raroïa — through the elemental dangers of storm on the grand scale and icebergs creeping north under fog. So *Varua* met the Southern Sea's worst and lived to carry her people up the Chile coast, to the guano islands, Panama — Hina was born under the American flag — and home via the Galápagos and Mangareva.

Robinson caps off his vigorous narrative with some "Appendices for the Practical Sailor."



Fisher. (From *Nature Roundup*, courtesy Harper)

The nature trail

Nature Roundup. By Robert E. Pinkerton. Harper & Brothers, New York. 1955. ix + 246 pp., line drawings. $3.50.

Animal Friends and Foes. By Osmond P. Breland. Harper & Brothers, New York. 1957. xvii + 259 pp., line drawings. $3.95.

These two books are at first glance so much alike one would expect them to be from different publishers at about the same time, not from the same house nearly two years apart. Both are compilations of facts of popular interest, presented by the short-question-long-answer method, grouped under major phylogenetic headings (Pinkerton: Mammals, Birds, Fish, Reptiles, The Physical World, Outdoor Life; Breland: Mammals, Birds, Reptiles and Amphibians, Fishes, Arthropods, Mollusks, Worms Coelenterates, Echinoderms, Protozoa). Between them, the coverage is pretty complete! Most surprising, there is much less duplication than one would expect — unless one may be permitted to *sus*pect that Texas professor of zoology Breland kept a copy of his journalist-woodsman predecessor's book in his desk drawer for peeks, thus generously avoiding that very thing. Anyhow, we are left with little choice but to commend both books for the raft of fascinating information they contain. A difference not indicated by the contents is that the professor, in professorial character, leans more to general principles, the journalist more upon specific questions.

Try Nature: *Guides to Health and Contentment in the Great Outdoors.* Edited by Robert S. Field. Vantage Press, Inc., New York. 1955. 238 pp. $3.75.

Anthologies of nature writing, or anything else, are as good as their sources, yet may be given further validity by the points of view of their compilers, if such are expressed to a degree in the selections, and in the commentaries if any. Robert Field believes that taking to the woods is a better investment of one's time than keeping up with the Joneses. His authors are "sages of woods and fields," their passages "potent prescriptions for our health and happiness through nature." It would be hard to cavil at his college of doctors: John Burroughs, John Muir, Henry David Thoreau, William Henry Hudson, Dallas Lore Sharp, Edwin Way Teale "and other outstanding nature writers, together with a goodly company of familiar, time-tested poets." There is a thread of topical continuity, including that of the seasons.

The Spirit of the Wild. By Dr. William J. Long. Doubleday & Company, Inc., Garden City, New York. 1956. 256 pp., line drawings. $4.00.

Many of the Setonesque animal stories of this contemporary of Teddy Roosevelt were published after Dr. Long's death in 1952, in *Sports Illustrated.* Not previously known to exist, they constitute something of a find in the nature writing field. It's first-hand stuff.

History in side pockets

The Seven Caves: *Archaeological Explorations in the Middle East.* By Carleton S. Coon. Alfred A. Knopf, New York. 1957. xx + 338 + xvi (Index) pp., 45 photos, 39 line drawings, 3 maps. $5.75.

"Caves," says Dr. Coon, "are fine vantage points from which to look out on the world." This in the opening chapter wherein he makes excellent sense explaining "Why Some People Dig Caves." In the search for signs of Stone Age man in the deep floor debris of his snug shelters along the southern border of the land below the ice, from Tangier through the Middle East to Afghanistan, Dr. Coon finds much more than bones and flint tools. He finds direct links betwen the human past and present and becomes as much involved in sympathetic relations with native pick and shovel men – some of them doubtless direct descendants of the people whose bones they dig – as in eager and painstaking reconstruction of a long gone time. The product of this dual interest is for us an utterly absorbing and often humorous narrative, and a fine wide look out on a fascinating part of the world as we travel with Dr. and Mrs. Coon from cave to cave. D.G.K.

Discovery north

Arctic Frontiers: *United States Explorations in the Far North.* By John Edwards Caswell. University of Oklahoma Press, Norman. 1956. xv + 232 pp., 26 halftones, 9 maps. $3.75.

So great and so relatively recent was the impact of Robert E. Peary's reaching the North Pole on April 6, 1909 – just 48 years ago – that the average American could probably name no one else among pioneering American Arctic explorers. Yet from De Haven's voyage in 1850 to search for Sir John Franklin's expedition, down to Walter Wellman's virtually forgotten first attempt in 1909 to reach the Pole by dirigible, Dr. John Edwards Caswell has marched a long line of American expeditions through the terse yet fully documented pages of *Arctic Frontiers.* A Stanford Ph.D., by turns historian, physicist, and analyst, Dr. Caswell has emphasized the scientific labors and results without neglecting the hardships and adventures of these expeditions, including those of Kane, Hayes, Hall, the *Polaris,* Greely, De Long and the ill-fated *Jeannette,* Schwatka, the *Corwin* cruise, and others. There is an introductory chapter outlining previous Arctic journeys from Pytheas (330 B.C.) down to Franklin, whose tragedy touched off the intensive efforts of the later 1800's. Specially pertinent to our "Arctic Amber" story is the chapter on "Explorations in Northern Alaska." Among interesting facts are that a party sailed from San Francisco to set up our first station at Point Barrow in 1881; that there was an International Polar Year, 1882–83; that many of our foremost Arctic explorers of those days worked with little or no Government support.

Mysteries of the North Pole. By Robert de la Croix. Translated from the French by Edward Fitzgerald. The John Day Company, New York. 1956. 251 pp., 4 halftones, 5 maps. $3.50.

Mention of polar exploration inevitably brings to mind those ships and men who have vanished, with or without trace, beneath the Arctic's armor of ice. The present author retells four classic accounts of polar exploration which ended in tragedy and mystery. These are Sir John Franklin's attempted crossing of the American Arctic archipelago in the *Erebus* and *Terror* in the 1840's – largest of all polar expeditions; the 1897 attempt of Salomon August Andrée to reach the North Pole in a balloon; the story of the Russian trawler *Saint Anne* (probably the least known to Americans); and the well remembered flight of the Italian Nobile in his dirigible *Italia,* which resulted also in the disappearance in northern wastes of the first man to reach the South Pole, Roald Amundsen. This is a book of well-paced narrative.

Arctic Wilderness. By Robert Marshall. Edited, with an Introduction, by George Marshall. Foreword by A. Starker Leopold. University of California Press, Berkeley and Los Angeles. 1956. xxvi + 171 pp., 29 photos, 6 maps. $3.75.

A bright name in the annals of exploration and wilderness appreciation and preservation is that of Robert Marshall, who did not live quite 40 years but achieved enough for twice as many. A professional forester, he explored in Alaska's Brooks Range because there alone on this continent could he find the ultimate "exhilaration of solitude in those few remaining places where no man has ever been before." But he also had a deep love for his fellows, and will be remembered for his best-selling *Arctic Village* (1933) in which he candidly portrays a wilderness-bound community and its people. Such was his regard for others that his one regret in breaking new ground was that he thereby lessened the unknown remaining to future explorers. These essays in exploration which his brother George has so fittingly provided with biographical perspective are as fresh and vigorous in style as the man who wrote them was robust in mind and gentle in spirit. In them, Bob Marshall lives yet to plead for the wilderness needed to refresh the spirit in us.

The Conquest of Mt. McKinley. By Belmore Browne. Illustrations by Belmore Browne and Bradford Washburn. Houghton Mifflin Company, Boston. 1956. xxx + 381 pp., 41 photos, endpaper maps. $6.00.

When Belmore Browne died in 1954 in his 74th year, he left with many of us at the Academy memories of his warm but modest friendliness during the months he was painting Mt. Kenya for the buffalo background in African Hall Annex. Now with the new edition of his book first published

Gratitude, grammar, and good ideas

EDITOR, *Pacific Discovery:*

Just a note to express my admiration for your Australian Number of *Pacific Discovery*. It looks absolutely first class, and as an Australian I am more than grateful that somebody in the United States should take such care over a journal devoted to my country. GEORGE FERGUSON

Angus & Robertson, Ltd.
Sydney, N.S.W., 29 December 1956.

EDITOR, *Pacific Discovery:*

I wish to state, that throughout 1956, I most certainly have enjoyed the many splendid articles. The January and February issue of this year is excellent and I wish to renew my subscription, please. Thank you for the reading enjoyment throughout the past twelve months.

(DR.) VIRGINIA FAHLEE

Midpines, Calif., 7 March 1957.

EDITOR, *Pacific Discovery:*

There are so many interesting facets to this renewing of my subscription to your wonderful and educational magazine, I thought you might like to know of some of them. . . .

I have a very close Mayan friend by name of Netzahualcoyotl, for short. His other names are not important at this time. He is pure Mayan, his mother and father both being Lacondones. His ancestors came from Palenque in Chiapas and his father's ancestors all from the fabulous Mayan city of Tulum, in the wilds of Quintana Roo, the only well known Mayan ruins to be constructed by the sea and actually facing the sea shore. My friend Netzahualcoyotl wears a fascinating necklace of jade, emeralds and gold drops which were dug up and given to him by his grandfather from the Temple of the Evening Star at Tulum before very many whites ever saw Tulum or Q.Roo. He gave me one of the jade and gold beads as a gesture of blood brothers according to his belief, after he had cut his right forearm and dipped them in his blood.

Netzahualcoyotl saw some copies of my *Pacific Discovery* and wanted to give me a gift for my Christian Christmas and so came the Pesos for the 3 years. Please send me the card so I may show it to the Mayan later.

ROBERT LEIGH

Emeryville, Calif., 30 November 1956.

Dr. Raymond M. Gilmore
Scripps Institution of Oceanography
La Jolla, California

Dear Dr. Gilmore:

This interruption in the reading of your article in the Jan.-Feb. 1957 *Pacific Discovery* is made to call your attention to an error that particularly sets my teeth on edge. It is on page 25: ". . . and three carcasses still remained near town for the inspection of Dr. Gifford C. Ewing and **I** . . ."

If authors submit manuscripts with grammatical errors, the magazine editors should employ competent proofreaders. Persons who are concerned about the correct use of language are, of course, in the great minority, but if the English language is to continue with a consistent basic grammatical structure it is indeed time that writers hold the line. BERNICE MCCOLLUM

Thermal, Calif., 17 February 1957.

Dear Miss McCollum:

You're dead right. It should have read "of Dr. Gifford C. Ewing and **me**. . . ." *Anyhow, I will certainly be conscious of this grammatical trap again — and so will the editor!*

Anyhow, I hope you enjoyed the article. If you think well of such types or kinds of articles, write and tell the editor. RAYMOND M. GILMORE

La Jolla, Calif., 23 February 1957.

CALIFORNIA ACADEMY OF SCIENCES:

I would like to suggest a few subjects for future editions of *Pacific Discovery*. In the [July-August 1956] issue there is a fine article on the old missions of California. I believe more articles on the missions would be interesting. These articles might deal with their locations, architecture, and present-day research and reconstruction.

Another series could deal with the national parks, monuments, forests and other public lands, the threats to these lands, and what is being done to preserve them.

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in 1913, Belmore Browne's permanent legacy to every enthusiast for the great literature of exploration is once more at hand for personal possession. To the original Foreword by Vilhjalmur Stefansson has been added a bibliographical and appreciative Introduction by one most able in this regard, Bradford Washburn.

Although the technical "first ascent" is that of Hudson Stuck in 1913, it was Belmore Browne and two equally courageous trail mates who won their way to the actual mountain top in 1912. The sudden staggering storm that like a stone wall kept them from the last 300 feet to the very summit, did not rob them of a true "conquest of Mount McKinley" and the honor of pioneering the way to one of the world's most challenging summits.

The Age of Mountaineering. By James Ramsey Ullman. J. B. Lippincott Company, Philadelphia and New York. 1954. 352 pp., 24 halftone plates, 6 maps and sketches. $6.00.

Here is the larger context in which Belmore Browne's McKinley story is set like a brilliant page, the view of mountaineering's achievements and short history, over the world and the decades. We live in one of the major geological eras of mountain building and consequent scenic grandeur. Yet for all the centuries before the last two, exploring man would set forth upon unknown oceans rather than dare the nearby peaks. Was it because man had first to come to a certain point in his mental and spiritual outlook, to accept a physical challenge yielding primarily mental and spiritual gains? At any rate, the age of mountaineering is as much of the present as the age of air and undersea conquest, so its story, here vividly and expertly told, is of and for our own time, nor is it done with the conquest of Everest and K2 — a long roll of unclimbed giants still beckons to something in man's soul.

Seed on the Wind. By Bill Geagan. Illustrations by the author. Coward-McCann, Inc., New York. 1957. 192 pp. $3.00.

This small but potent book, which has been remarked upon editorially in this issue, should be read thoughtfully by every man with a growing son, grandson, or nephew — most particularly by every father of a son. It is not too much to believe: Bill Geagan's claim that the boy who has learned the way of the wild — the way of the outdoorsman, reverent of nature — will never become a social liability, a "delinquent" to use the ugly term. This is a book for the city man, most of all, who needs to be reminded of that way, how to get back upon it, taking his sons along with him so they may know it from the beginning. D.G.K.

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And finally there might be articles about our Western trees, shrubs, Indian mounds, and climate.

Sacramento, Calif., 7 March 1957. DONALD VAUGHAN

Thank you. Reader comment and suggestions are the most welcome items in the editor's mail. We've been short on missions; those of Baja California were pictured in 1953. Parks, monuments, and other public lands viewed conservationwise and otherwise include: Jackson Hole, Western ranges and watersheds (1948); California beaches, redwood and big tree groves (urging their being made public), Rainbow Bridge N.M. (1949); San Jacinto Primitive Area, Western ranges, Yosemite N.P., Mount Rainier N.P., Grand Canyon N.P., Sequoia N.P. (1950); Yosemite, Three Sisters Wilderness Area, timber lands (fire protection), Yellowstone N.P. (fossil forests), Chiricahua N.M. (1951); Olympic N.P., Death Valley N.M. (1952); Barro Colorado Island (Canal Zone), Canyon de Chelly N.M., Alaska's parks and monuments (1953); Olympic and Yosemite parks, Dinosaur N.M. (1954); Joshua Tree N.M., San Jacinto area, Saguaro N.M., California state parks (1955); Dinosaur N.M., "Great Basin Range National Park" proposal (1956); Channel Islands N.M. (1957).

The pines of California; Sequoia and Metasequoia; California black walnut; saguaro and other cacti; desert ironwood, smoke tree, palo verde, mesquite, catsclaw, desert willow; bishop pine; California fan palm; elephant tree; Kauri (New Zealand) and eucalyptus (Australia); Joshua tree; pines on Cedros Island — these and other trees and shrubs have been described and pictured. More will come, of course. The shell-mound story is "on the fire." As for climate, even that controversial subject is slated for discussion in future. ED.

Hooray!

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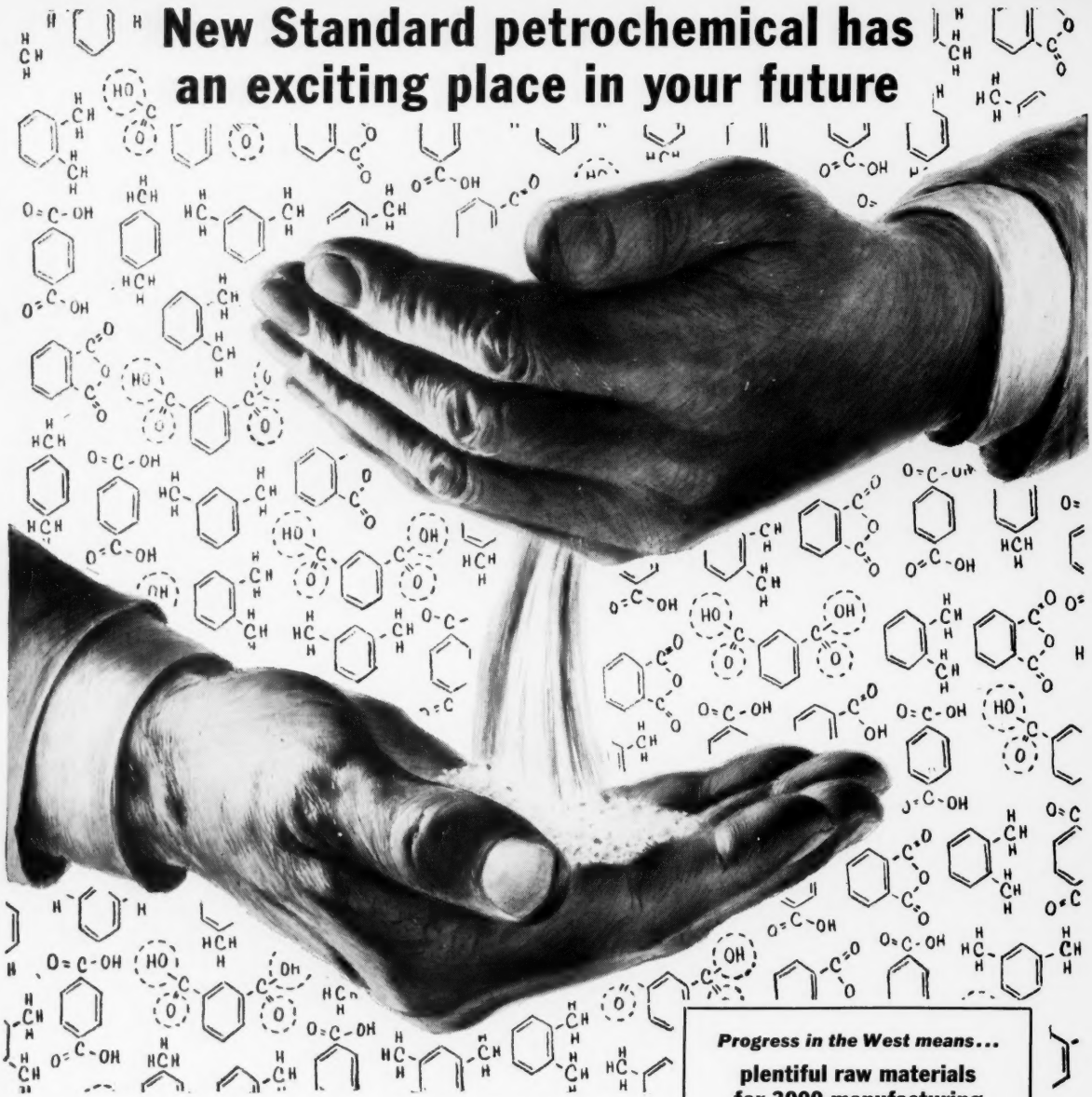

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